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THE IDEA OF PROGRESS: EASTERN AND WESTERN

THE Western concept of progress needs to be modified at an essential point if it should not be extravagant and therefore misleading. Progress, if taken as implying continuous, uniform and illimitable improvement in our conditions of living, is nothing more than pleasant fancy-play. As improvements do certainly take place in some parts of our life and environment in consequence of the free functioning of man's will and intelligence, impairments too do as certainly set in in other parts. Seeds of the latter are as much a part of our nature as seeds of the former.

> ..... Progress is
> The law of life; man is not Man as yet.
> ..... Progress, man's distinctive mark alone,
> Not God's and not the beasts'; God is, they are,
> Man partly is and wholly hopes to be.
>
> —BROWNING

Progress or improvement may relate to either or both of two totally different things: to man's outward state and circumstance and to man himself. Not only material conditions and social environment,—wealth or poverty, health or sickness, education or ignorance, freedom or slavery, justice or inequity,—but also intellectual and æsthetic conditions must be counted as pertaining to the exterior. What makes the man himself are the postures and proclivities of his soul,—how it looks upon the objects of the senses, how it yields to or resists temptation, how it reacts to defeat or victory, how it regards life-entities other than itself. It is true that the subjective and the objective in us are closely interrelated and modify each other. But the question is—which of the two predominates. The Vedanta postulates a degree of freedom of judgment and of action for the human individual—a degree that has within itself the potency for further growth. If man uses his freedom of choice properly, his soul's emancipation

is merely a matter of time. Progress in the subjective sense is the soul's ability to control its own impulses and bring into mutual harmony the stimulii offered by the objective world and its own reactions thereto. In this sense, the progress of the world has not kept pace with the advances which science has made possible to it in realms of external existence. In the weighing and valuing of the paraphernalia of life, instead of the soul forming the fulcrum of the balance, it has become a neglected quantity in the modern world. The reason for this may partly be in that religions, which are particularly concerned about the soul, are not unanimous among themselves in their intimations and are confusing in the variety of their counsel; and further in that they have not been able to withstand the onslaughts of science. Partly it may be in that science, which began the offensive upon religion, has itself not been able to find anything positive to offer as a substitute for bringing those ministrations to man which formed the office of religion. And the new paraphernalia designed and perfected by science are so alluring and so gratifying to the bodily senses as to expel from the mind all thought of the soul. But the soul persists and is real. It is the only thing really real. Its ignoring has led to an erroneous sense of values; and in the train of that error have followed illusion and tragedy. The true foundation of the new world-order must therefore be laid in the souls of men. It is right souls that make a right world. If our effort to establish a new world-order of peace and freedom should be more successful than previous attempts in the same direction, our first business it should be to restore the soul to its sovereign place in the scheme of life. The mission of the Vedanta is to see to this.

Progress, in the sense that the conscious, conscientious and all-sided pursuit of improvement in our conditions is a duty, is undoubtedly a rational and inspiring ideal. But to assume that improvement is bound to follow uninterruptedly and without limit so as to convert our very earth on some near enough day into the Paradise celebrated by poets and prophets is to feed our minds on a false hope and to ensure ourselves endless disappointment. There is always bound to be disparity between ideal and achievement in a field where there is greater uncertainty in the material and in the instrument than in the design. Man's powers have seldom proved sufficient for man's purposes. Purposes are fashioned inside the mind and the heart; achievement depends upon external factors; and the best directed effort is often suddenly interrupted by a snag that was not till then suspected. Such is the illimitable complexity and incalculability of the forces of human nature. There is an ancient dualism in human nature—the egoistic and the bad placed in intimate association with the altruistic and the good. Man's true progress is in shedding the first and transcending the second and finally reaching a tertiary state in which there is no consciousness of either "I-ness" or "other-ness" and therefore no question of resisting either the good or the bad,—but there is only the "Oneness of All" realized in one's consciousness, and in which as a result the qualities we call goodness and kindness proceed from one spontaneously and without effort, like the breath in one's nostrils. But

this tertiary condition is only for individuals, and individuals of highly evolved natures. When that is reached, the goal of progress is reached. In other words, there is a finality practicable to the moral and spiritual progress of the individual man,—a stage of perfection when there is no more need for striving, no more seeking, no more want, no more toil. Such a man acts his part in the cosmic scheme as though it were a vast complicated play and he an appointed actor in it, and is never pained or excited at heart. To him only is there a place of rest at the end of progress. To all others, progress is a perpetual process of yearning and struggling, achieving partial improvements and suffering partial frustrations. While one set of impulses within us goes on bringing about ameliorations and felicities, another set keeps introducing deteriorations and perversities. Verily, the business of material and social progress is like repairing an ancient fort or mansion. While alterations and renovations go on in one part of the structure, sags and crevices keep on appearing in some other part. We as a race are like an old rheumatic; you may drive out the pain from the knee, it will re-appear in the ankle; you can never completely expel it from the entire body.

The Vedic seers have likened human life to an *Aswattha tree* (the Sacred Peepul, *ficus religiosa*), but an *Aswattha* growing inverted—roots up above and branches down below. The meaning of the symbol is that our life has its origin in high heavens, immortal and beyond any mortal's reach, and that it is only its temporal and spatial manifestations that move about here on earch. The word *"Aswattha"* means—"not tomorrow as it is today". It is a wonderful tree, ever-changing and yet ever-lasting. The most noteworthy fact about this long-lived tree is the juxtaposition of branches dry and decaying and branches bearing fresh shoots of golden foliage. It is growing old and growing young simultaneously. Onset of age in one part and renewal of youth in another are its normal condition. That is the story of the world's progress as well.

To discard the exaggerated part of a hope is not to abandon all hope. To admit the possibility of some conditions worsening while some others get better is not to suggest either that the idea of progress is a delusion or that human effort at improvement is a futility. Whether crowned with outward success or not, man is inwardly all the better for his effort. His will and intelligence undergo a discipline in the process, and so grows his mastery over himself and his environment. That, at any rate, is a gain, an incidental gain though it be; and a capital gain it is. This, it seems to me, is the meaning of the Gita's teaching of duty without thought of consequence,—of right deed without expectation of reward.

Progress in conditions of outward existence is certainly possible, but not perfection. Perfection is possible only in the realm of the soul, and that only after prolonged effort and evolution. And imperfections in the outward progress are of use as spurs to the inward progress.

* * *

To put the matter categorically, the message of India to the world may be said to comprise broadly three points:

(1) The recognition of an all-enveloping and all-pervasive Power in whom and through whom all beings are put in relationship with one another; whose workings reveal both cosmos and chaos, both order and caprice; who seems to uphold the law of *Karma* and yet to supplement that law by prerogative dispensations; and to whose providence all human wills and endeavours are subject.

(2) The freedom and therefore the responsibility of every man to choose and follow that line of conduct which is, rather than that which is not, in accord with his acceptance of his kinship with all living things and which therefore is in harmony with universal life. This is *Dharma*, and it implies the duty of striving to uphold justice and goodwill and to effect improvements in conditions of existence.

(3) The moderating of one's desire for material possession and sense-gratification by a constant remembrance of the naturalness of similar desires in others and of the limitedness of nature's resources within man's command as well as of the defects and perversities of human nature and, withal, of the comparative ephemerality of the things of the earth.

Practising oneness with all life, judging of right and wrong in the light of that vision of Oneness, and shaping one's relations with the world in consonance with that scale of values, restraining selfish ambition and standing up for righteousness regardless of consequence,—in one word, finding joy in renouncing the narrow separatist self and cultivating that larger self which sees its counterparts in the universe around—that is the spirit of the Vedanta. Is there not need for its infusion into relations between class and class and country and country today? Indeed, without a general acceptance of that spirit, world-reconstruction can never proceed smoothly, and the world can never come to find peace. More than any nice apportionment of the world's goods among countries and classes, more than any delicate contrivance of governance, more than the limitation of armaments and more than international pacts and treaties is the spirit in which men look upon life and its relationships. Have they persuaded themselves that life is a thing sacred and precious, lovingly and carefully to be treated? Have they come to see that promoting life for all is better than increasing life's paraphernalia for some at the expense of others? Have they learnt to prize peace above possession and justice above glory? If they have, the New World-Order of which we dream today will surely be a fact some day. But if the world will not learn the lesson, our escape can be only from one kind of chaos into another.

The characteristic difference between the Indian and the European, or the Oriental and the Occidental, as regards their attitudes towards life's problems and tasks is to be seen in how they habitually react to defeat and disappointment. Aspiration is common to both, and so is striving. Both alike plan for the right and the good, and both struggle for it with the best of their skill and strength. But when, for all that best, failure and frustration confront them, the Oriental's first thought is of an invisible

Judge who dispenses all things from above and whose scale of values and calendar of events may not coincide with his (the man's) own; whereas the Occidental's mind turns at once to find in the world around some one responsible for the miscarrying of his plan and to deal with him suitably in the expectation that when that source of trouble is set right, the rest of the path will be smooth and easy. The Oriental does not lose his peace and balance of soul; he declines to take the defeat of the moment as the final outcome of his effort and will wait on in hope, not swerving from the good path and continuing to trust himself to the working of the higher Power. The Occidental on the other hand is thrown off his balance by impatience,—well-meant impatience though it be,—lets himself be moved to some desperate action against some one or something in the established order and insists on either mending things according to his own scheme or ending himself. Quietism comes sooner to the first, violence sooner to the second. The difference between the two is made by the part assigned by them respectively to the Superhuman in human affairs. The Hindu believes that man can never be self-sufficient and must learn to reckon with something outside of himself and his world. The European thinks that human instruments must suffice for human purposes, and if they ever fail, the fault must be looked for in the method of attack, not outside the world. The Hindu takes it as established that a certain modicum of suffering will remain to be borne here on earth, even after the very best that human intelligence and energy could achieve has been achieved. The European refuses to put up with any kind or degree of suffering as irremediable and would go on vexing himself and vexing others in his quest of a remedy.

Pushed beyond a point, both the views must prove equally pernicious, the first leading to passivity, the second to fretfulness of spirit. In a moment of tiredness of body or dimness of mind, one might easily persuade oneself that one's very best has all been done and finished, and cease further exertion in the name of submission to the will of God. There is always the possibility of one's mistaking sluggishness of intellect or of conscience for the exhaustion of one's vital sap or for the adverseness of fate, and attaching to cowardly or indolent shirking the pious label of resignation. On the other hand, there is equally the danger of one's trying to overreach oneself, forgetting that after all there is a limit to human energy and resource, and wasting oneself in a perpetual whirl of impassioned activity that can bring no peace or satisfaction either to oneself or to those among whom it is carried on. The first kind of error or delusion brings on faint-heartedness, fatalism, stagnation; the second is the road to fidgetiness of soul, to turmoil, to anarchy. Neither can mean progress.

But the two views, when not pushed to extremes, are not antithetical; and it is the task of wisdom to make a synthesis of them. Search for improvement fortified by preparedness not to chafe under such failure as may come inevitably, strive to reform society without breaking its foundations and tearing its decalogue to pieces, work with zeal and yet be resigned as to the result—such is the synthesis to be reached. Resignation should co-exist with activity. It is not after the feeling of self-

exhaustion comes that one should invoke the spirit of resignation; for, as already observed, one can never be sure when that feeling in one is well-founded and when not. Whether one is full of energy and enthusiasm or is feeling weak and hopeless, the need for submission to the Invisible Judge is always there; and equally, for the same reason, namely—that one can never be sure of the correctness of one's own self-analysis, the need for incessant exertion also is always there. "Toil unsevered from tranquillity"—that should be the motto.

> One lesson, Nature, let me learn of thee,
> One lesson which in every wind is blown;
> One lesson of two duties kept at one
> Though the loud world proclaim their enmity—
> Of toil unsevered from tranquillity!
> Of labour, that in lasting fruit outgrows
> Far noisier schemes, accomplished in repose,
> Too great for haste, too high for rivalry!

A national culture produces some distinctive intellectual or moral ethos—a faculty, a habit of mind, an ideal—which is of value to other nations. The product, if accepted, will gradually become absorbed into their life-processes and after a time lose its distinctiveness. It will afterwards be one among the various strands of international life and so a part of the world's possession. It is no longer either only oriental or only occidental; it is both, indeed universal. That great minds, being trans-national and universal, are able instinctively to reach a synthesis of the dominant notes of the East and the West is shown by the lines of Matthew Arnold above quoted.

Man's conquest, if it can be full and unqualified anywhere at all, can be so only in the inner world, over his own nature,—not in the outer world, not over cosmic nature. In the outer world, his triumphs can only be partial and qualified, because of the intractibility of other factors which are partners with him there. Complete triumph and the joy thereof can come to him, even though after ages of preparation and ordeal and self-purification, only in the inward realm, the realm of the spirit.

[*From an address delivered by Mr. D. V. Gundappa to the Joint Easter Session of Science Associations in Bangalore on the 4th April 1942.*]

DEVELOPMENT OF INDUSTRIES IN INDIA

"ALMOST any article can be manufactured in this country. What the country needs is a proper industrial structure and organisation backed by the Government and by the joint strength of the leaders of industry and trade or at least by one of these agencies. At the end of this war, it should probably be necessary to launch industrial schemes involving an outlay of, say, Rs. 1,000 crores or more on a five-year plan. This sum is not large, considering the vast resources of this country and the enormous size of its population.

"At the end of the war, we must plan to make our own industrial machinery with the help of machine tools freed from munition manufacture both in this country and abroad. At the end of hostilities, the belligerent nations will have considerable replacements to make for their own needs, and they will not be able to spare for us industrial machinery and shipping space to the extent that we will require. At present we should push on with the extension of machine tool-making in India."

—SIR M. VISVESVARAYA.

[*From an address delivered before the first meeting of the Central Committee of the All-India Manufacturers' Organisation, Bombay.*]

SPECTROSCOPIC INVESTIGATION OF THE SOLID AND LIQUID STATES

BY

SIR C. V. RAMAN

AMONGST the instruments of precision at the disposal of the physicist for the investigation of the structure of matter, the spectroscope occupies the premier position. It may be recalled that our present ideas regarding the structure of atoms and molecules are largely based on the experimental facts revealed by spectroscopy. It is scarcely to be doubted, therefore, that we have similarly to rely on spectroscopic research for an elucidation of the nature of the solid and liquid states of matter. These are not static structures in space, and even a purely geometric description of their build is, therefore, scarcely possible without the use of spectroscopic terminology. When we pass to deeper physical considerations and seek to evaluate the forces which hold together these aggregations of matter, we realise that spectroscopy gives us both the means of investigation and the language to express our results. It follows that a real knowledge of the solid and liquid states—as distinct from purely hypothetical postulates and assumptions—must rest upon a foundation of exact knowledge garnered by experimental spectroscopic research. The symposium of papers now under notice* seeks to provide such a foundation.

When we apply spectroscopy of the visible and the ultra-violet to investigations on solids, three distinct paths of research open out. These are respectively, studies on luminescence, on absorption and on the scattering of light. The case of diamond has been thoroughly investigated in all the three ways by Mr. P. G. N. Nayar and the results so far obtained are described in the two opening papers of the symposium. Nayar's work in the main furnishes a striking confirmation of the early work of Bhagavantam on light-scattering in diamond. The studies on luminescence and absorption have yielded new results of great interest. It is shown that the fundamental vibrations of the crystal lattice of diamond form a set of discrete monochromatic frequencies, of which no less than 19 have been recognised and measured. These cover the whole range of frequencies comprised in the so-called "elastic" spectrum of Debye, but their appearance as discrete frequencies with the observed distribution of intensities is a direct contradiction of the postulates on which Debye's theory of specific heat is based. Nayar also obtains the remarkable

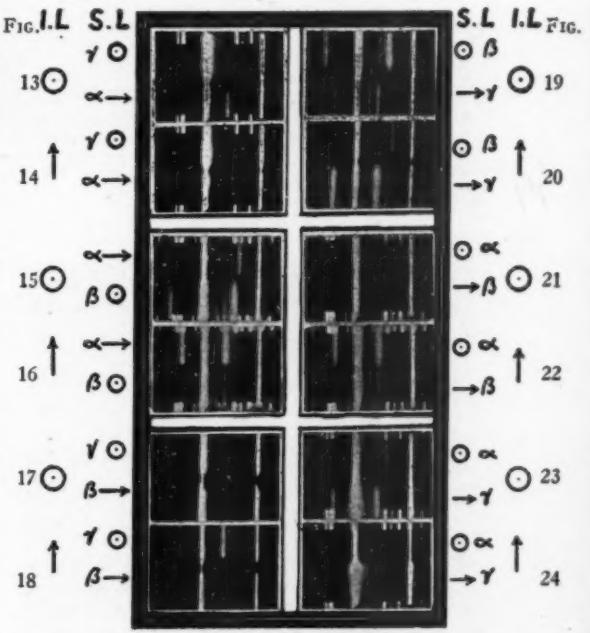

FIG. 1

Low-Frequency vibrations in a naphthalene crystal

experimental result that the electronic absorption frequencies of diamond from a set of sharply-defined frequencies at low temperatures. Some 25 of these are listed in the paper.

* Symposium of papers on Fluorescence, Light Scattering and the Raman Effect. *Proceedings of the Indian Academy of Sciences*, 'A' Series, May 1942.

Spectroscopic studies on light-scattering in crystals reveal, in addition to the so-called "internal" frequencies of vibration of the ions or molecules, if any, present in the crystal, other discrete frequencies which are usually much smaller. These appear as sharply-defined lines in the spectrum or else sharpen to such lines when the crystal is cooled down to low temperatures. The observed frequencies lie in the remotest infra-red region, and their appearance and spectral character seem irreconcilable with the ideas either of the Debye theory or of the Born crystal dynamics which demand that the vibrations of crystal lattices form *continuous* spectra. It is *prima facie* evident that these discrete low frequencies are characteristic of the crystalline state and that they play a fundamental role in all branches of crystal physics. Their identification and explanation is thus a matter of prime importance. In a very beautiful investigation from which we reproduce the accompanying illustration (Fig. 1), Mr. T. M. K. Nedungadi shows that a naphthalene crystal exhibits six such frequencies in light-scattering, instead of four as hitherto supposed. When the orientation of the crystal and the state of polarisation of the incident light are varied, the intensities of the lines alter in a remarkable way. It is deduced from these observations that

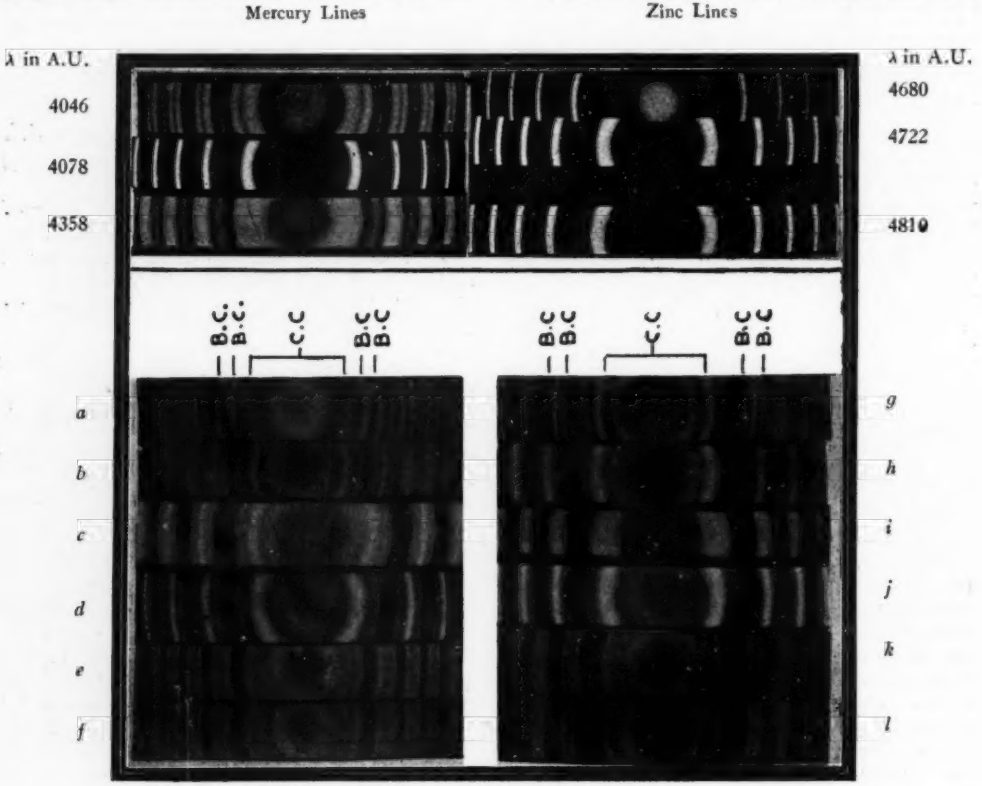

FIG. 2. Interferometer Patterns of Light Scattering in Liquids.

a. Water (30°)
b. Cyclohexane (30°)
c. Carbon tetrachloride (25°)
d. Benzene (28°)
e. Ethyl alcohol (25°)
f. Ethyl alcohol (65°)
g. Acetone (28°)
h. Acetone (54°)
i. Ethyl ether (30°)
j. Tetralin (30°)
k. *iso*-Butyric acid (25°)
l. *iso*-Butyric acid (154° C.)

the observed frequencies correspond to the six possible symmetric and antisymmetric rotational oscillations of the two molecules present in the lattice cell.

The development of a zinc-amalgam lamp giving monochromatic radiations of high intensity free from disturbing satellites has enabled Dr. C. S. Venkateswaran to carry out spectro-interferometric investigations of great value on the scattering of light in gases, liquids and solids. The perfection of his experimental technique and the thoroughness of the research has enabled results to be obtained which are trustworthy, besides being of fundamental importance. The work has also been effectively followed up by Mrs. K. Sunanda Bai. Seven out of the fifteen papers in the symposium are devoted to the work of these authors. We reproduce in Fig. 2 an illustration from one of Venkateswaran's papers.

The work of Venkateswaran and Sunanda Bai shows clearly that the conclusions reached earlier by experimenters as well as theorists in this field need radical revision. The picture of the liquid state which now emerges presents little or no resemblance to that of a crystalline solid, the analogy being rather with the amorphous or glassy state. The more viscous the liquid or the lower its temperature, the more nearly does it approximate in its behaviour to a glassy solid. This statement, in fact, covers the experimental situation as revealed by the studies on the positions and intensities of the lines in the interferometer patterns, as well as their states of polarisation.

The so-called "internal" vibrations of the molecules which become manifest in light-scattering also receive attention in the paper of Nedungadi on naphthalene mentioned above. They form the principal theme of three studies with organic liquids contributed to the symposium by Venkateswaran and Pandya. Nedungadi's work shows clearly that the selection rules for these internal vibrations are determined primarily by the symmetry of the crystal in which the molecules are imbedded and only secondarily by the symmetry of the molecules themselves. It is also evident from the investigations that even in the liquid state, the vibrations of an individual molecule are strongly influenced by those of its neighbours.

Limitations of space permit only a brief mention of B. S. Satyanarayana's paper on the relation between fluorescence and light-scattering in uranyl salts. This is a preliminary report of a very promising investigation.

THE EFFECT OF CIRCULATION UPON THE WEIGHT OF METAL CURRENCY

BY

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IN contrast to the physical sciences, the social sciences allow, even now, the detection of quite important effects with the aid of comparatively simple apparatus and a certain amount of knowledge of modern statistical technique. The historical evidence of the demand for currency shown by the loss of weight of coins still in active circulation comes under this head. The same methods may be applied to hoards deposited in ancient times and recovered intact, thus giving the foundations of numismatics as a science.

The normal law of weight distribution may be assumed to hold for a set of coins honestly minted to a fixed legal standard in large numbers. The population mean may be taken as the supposed legal weight, the variance could be estimated by taking the number of rejections at the mint beyond the fixed "legal remedy" by which the coin is allowed to differ from legal weight. Supposing the minted weight distribution to be represented by I in Fig. 1 (and ignoring the absorption of the coinage), the effect of circulation will be to lower the mean and to increase the variance, as in II. Further circulation changes the curve to III, where only the heavier half has been drawn. Deviations from normality will become more strongly marked and the currency will tend to disappear from circulation. While the general case can be brought under the "homogeneous random process"[1] which is so

universal in application as to qualify for a law of nature, it suffices for comparatively short periods of time to take the average weight as a linear function of the date.

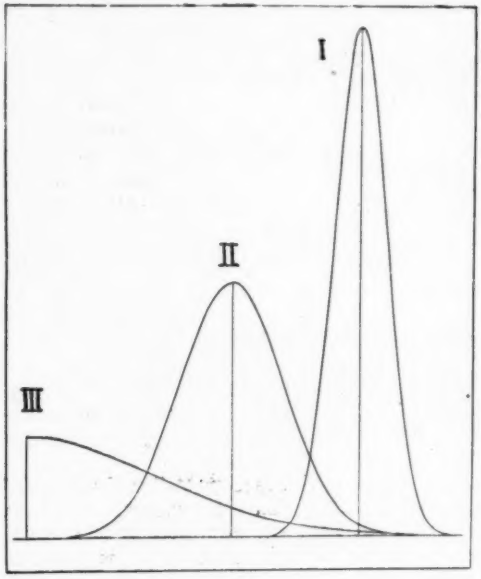

FIG. 1
Effect of circulation on weight

This theory was applied to a statistical analysis[2] of the earlier Taxila hoard (deposited *circa* 317 B.C.), but work on other ancient hoards of interest was prohibited by lack of access to the material and by the honoured custom of scattering most such material *unweighed* after a perfunctory study. So, the validity of the theory is here proved on modern coins from active circulation,[3] as a control measure. During March and April 1942, I gathered from some stores in Poona, from the great marketplace (*maṇḍai*), and when not otherwise available, from the day's take over the counter of a local bank as many specimens as my finances permitted and my energy sufficed to weigh. These were stripped of the pieces whose date was illegible, or which were severely damaged by accident, or which did not ring true for the higher denominations. Experience shows that, as regards weight, coins of the latter two classes invariably differ in a marked fashion from the rest of their annual group; for the first, there was no choice. The effect of the two latter discards is to decrease the variance within a year, so that the goodness of fit is actually reduced by this process and the theory stands confirmed even under the most unfavourable circumstances. The date on worn specimens could probably be restored by means of an examination of the crystal structure formed at the time of stamping, but I was unable to devise any method with the apparatus at hand. The pice were taken as they stood; for the other currency, modern specimens, minted in 1936 and after 1939, were in overwhelmingly large proportion, and subsamples had to be taken to reduce the numbers. The final selections were classified according to the date of the issue and each coin weighed to a tenth of a milligram. The time of the weighing was reduced by using a chainomatic analytical balance of Indian manufacture; the error of the (new) instrument was rather high—½ mgm.—but decreased with use. Proper checks were taken regularly, and the fourth place of decimals ignored in the statistical work; all means would have to be increased by half a milligram and Sheppard's corrections necessary for the variances of the data were to be used for purposes of estimation. The final stage was the statistical analysis of the weights by the methods of R. A. Fisher.[4]

With larger samples the estimates of composition and even of the actual weight and its variance would be more accurate; reliable information could be gained as to the proportion of counterfeits, mint-defective, dumb, and accidentally damaged coins in circulation. The variation between localities and local needs can also be estimated by the allocation of properly randomised samples to various regions. Finally, the residuals after fitting the regressions would be of great use in correlating the wear of various denominations to show the extent to which one type was supplementing another and enable a scientific distribution of currency to be made. Any method of currency control based on science, not on the fiat of authority, would have to consider these matters seriously. As for the weights of a large sample, the analytical balances will no longer be necessary; a histogram can be run off directly by setting the mint's automatic weighing machines in series and counting the number of coins not rejected at each step.

A look at the tables of analysis of variance shows at once that the results of

Analyses of Variance. Regressions given only where significant

Unit: one milligram; y = weight in milligrams, x = date in years

Source	d.f.	sum-square	mean sq.	F
Æ *Pies* (*Benares*) 1912–1939; y—1599·55 = 1·955 (x − 1929·12);				
regression	1	43015	43015	36·66***
deviations	23	61528	2675·13	2·28**
within a year	198	232300	1173·23	$r = 0·357$
Total	222	336843	1517·31	1·29*
Æ *Pice* (*superseded*) 1835–1906.				
regression	1	35969	35969	$(5·95)^{-1}$
deviations	27	7133371	264198·92	1·234
within a year	99	21195723	214098·21	$r = -0·0356$
Total	127	28365063	223346·95	1·0432
Æ *Pice* 1907–1941; y—4728·86 = 9·903 (x − 1928·87)				
regression	1	8574800	8574800	1663·96***
deviations	26	201108	7734·94	1·50
within a year	639	3292918	5153·24	$r = ·843$
Total	666	12068826	18121·36	3·516***
N *Annas* 1908–1941; y—3803·20 = 6·545 (x—1927·70)				
regression	1	3250147	3250147	1903·31***
deviations	26	132110	5081·15	2·975***
within a year	698	1191923	1707·63	$r = ·843$
Total	725	4574180	6309·21	3·695***
N 2-*Annas* 1918–1941; y—5759·2 = 8·516 (x—1931·99)				
regression	1	1890586	1890586	695·86***
deviations	16	71021	4438·81	1·63
within a year	315	855827	2716·91	$r = ·819$
Total	332	2817434	8486·25	3·12***
AR 4-*Annas* 1904–1940; y—2857·9 = 4·615 (x—1928·098)				
regression	1	725568	725568	459·70***
deviations	21	56104	2671·62	1·69
within a year	224	353551	1578·35	$r = ·799$
Total	246	1135223	4614·73	2·92***
AR 8-*Annas* 1905–1941; y—5764·83 = 5·949 (x—1928·5)				
regression	1	259759	259759	139·86***
deviations	21	31273	1489·19	$(1·2472)^{-1}$
within a year	43	79865	1857·32	$r = ·837$
Total	65	370897	5706·11	3·07***
AR *Rupees*[3] 1903–1920; y—11579·86 = 4·16 (x—1913·12)				
regression	1	15423	15423	674·67***
deviations	16	1130	70·63	3·0898***
within a year	2868	65563	22·86	$r = ·433$
Total	2885	82116	28·463	
AU *Sovereigns* 1900–1931.				
regression	1	72	72	2·382
deviations	11	776	70·54	2·333*
within a year	39	1179	30·23	$r = ·1885$
Total	51	2027	39·745	1·315

my observations are highly favourable to the theory. Where deviations from the linear regression become significant, they are immediately explicable. The pies being not current in Poona bazaars had to be imported from Benares where they are gathered from the shops before Hindu holidays by the frugal pious, distributed to beggars, and revert to the shops immediately after. This can hardly be called active circulation; as an aside, be it noted that in places like Benares simple bits of copper can be and are still used to substitute for the lower currency: for Benares, the Butwal "pice"; almost any ancient coin in most of the purely agrarian districts of India.

The Poona pice fall into two classes, the weight of the denomination having been

materially reduced in 1907, apparently to 75 grains. In fact, all pice of my 1906 sample fall into either the 4-gram or the 6-gram group, without a single specimen of 5 grams; the mean for this year is very significantly lighter by the t-test than for previous years, heavier than for succeeding years; the variance by the z-test is significantly greater than those before or after. This seems to indicate that some of the 1906 pice were minted to the lower weight. Thus, the pre-1907 coins have been withdrawn for the greater part or have otherwise tended to disappear from circulation. Only the unworn specimens have managed to survive, whence neither the regression nor the deviations from it are of any significance. For the nickel one anna coins, the deviations from regression are caused entirely by the oldest issues: Edward VII, 1908–1910. For these, no less than 15 out of a total of 38 had illegibly worn dates, a proportion fourteen times that of the George V issues. The 23 coins retained were, naturally, heavier than the average for their groups, somewhat after the fashion of III in Fig. 1. A precisely similar effect is to be seen in the Taxilan coins of more than ten reverse marks. A recalculation of the anna data discarding the Edward VII issues immediately reduces the deviations from linear regression to insignificance, so that the deviations are to be assigned to our mechanism of selection. We can thus state a law of wear for metal currency: *For coins in active circulation, the loss of average weight is proportional to the age. But the oldest coins of a series tend to be above the regression weight and for currency not in active circulation*[6] *or an issue which is superseded, the significance of the regression tends to disappear.*

An even more striking result is that *the correlation coefficient for currency in active circulation over comparable periods of time is independent of the denomination.* Except the pies, the older pice, rupees, and sovereigns all the remaining correlation coefficients do not differ significantly from the population value of $\rho = 0{\cdot}838$, estimated by pooling the observed values after Fisher's z transformation.[5] The correlation for the 4-anna bits is somewhat low, but there have been disturbing factors at work here: the 1917–1918 specimens show unusual wear and nickel 4-anna bits (not included in this study) were minted in 1919, 1920, 1921. In stating such a "law" for currency weights, other things must be equal: minting variances must not be great in comparison with those caused by wear, the currency must have been minted over about the same period, and must have circulated in the same locality over about the same time. As a matter of fact, 2,886 rupees of 1903–1920 issue sampled at Poona in 1940 gave me a correlation of ·43 and deviations from linearity were insufficient to explain this entirely different value. The reason for the difference, however, is very simple. It is known that r^2 is the ratio of sum square due to regression by the total sum square. Our theory requires that the variances increase with age, which means that for coins longer in circulation, the residual sum square takes up a greater proportion of the total, thus depressing the correlation. Even the pice of our sample show a correlation compatible with that of the rupees when calculated only from the 1907–1920 issues in the sample. It is a feature of the data that when the calculations are made from year to year on the basis of the weights, the correlation coefficient is found to increase steadily with the date of the last issue to its maximum value at the end; this holds for all denominations provided the oldest issues do not contain overweight survivors in large proportion and the regression is really significant.

Whereas the samples show that the variances are in general decidedly greater for the older issues, the samples do not allow the question of linear increase of the variance with age to be effectively discussed except for the post-1906 pice. The only method I can see that would test this would be (1) to calculate the linear regression from the sample variances, giving each the weight of its degrees of freedom, (2) apply the χ^2 test, noting that the ratio of the observed to a hypothetical variance should be distributed as χ^2/n. From the total number of degrees of freedom, two have to be subtracted for the fitting. The pice variances only, when all are tested by this method, show linear increase with age; on the whole, the pice are statistically the most satisfactory denomination—in spite of evidence of heavy corrosion of three specimens by fatty acids—because no one rings them, counterfeits and hoarding are absent, change of hands regular.

Brass ½ annas, annas, and two annas of

1942 issue just reached circulation at the time of the study, so that no disturbing effect was obvious on the rest of the currency, whatever the future may show. The data gives: ½ annas—$n = 53$, $m = 2{\cdot}9125$ gm. $s^2 = 786{\cdot}88$ mgm.^{2}; annas—$n = 38$, $m = 3{\cdot}8851$ gm., $s^2 = 3934{\cdot}51$ mgm.^{2}; 2 annas—$n = 22$, $m = 5{\cdot}8023$ gm., $s = 7773{\cdot}6$ mgm.^{2} The two last fit very well into their respective lines of regression and analysis of variance. It is not likely that the debasement will cause any disturbance due to hoarding, though the rate of wear will naturally change. For, the silver alloy had already changed nearly three years ago from 11/12 to 6/12 fine; even the nickel of Geogre VI appears to differ from the older composition. Even with the pure metal used for each denomination, including the rupee, the currency would have a value of metal well below its denomination, hence the change to brass only emphasizes the most universal of all numismatic laws, the inevitable trend towards debasement in times of stress. For our purpose there is a far more serious effect visible in the samples. The minting since 1939 shows a decided increase in variance, and the occurrence of overweight specimens shows that the old legal remedy (from 1/40 for copper to 1/200 for silver) has been relaxed in practice, whatever the law at present. If this tendency was present in the coins struck during the last Great War (1914–1918), or during the depression years, it is certain to upset the linearity of variance increase, without affecting the law for mean weights. Whether the tendency towards cruder striking of the coins with regard to weight is manifested in other countries and periods before great changes of structure will also have to be studied with this example in mind.

I am grateful to the kind friends who saved me much of the labour of gathering the samples in an unusually hot summer. Special thanks are due to my geological colleague Prof. K. V. Kelkar for going out of his way to place the facilities of his laboratory at my disposal.

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[1] A. Kolmogoroff, *Math. Annalen*, **1931**, **104**, 415–458.

[2] D. D. Kosambi. *New Indian Antiquary*, **1941**, **4**, 1, 49.

[3] ————, *Current Science*, **1941**, **10**, 372.

[4] R. A. Fisher, *Statistical Methods for Research Workers* [7th ed.], ex. 42.

[5] *Ibid.*, ex. 33.

[6] The gold sovereigns have had almost no circulation, but if just two more specimens, dated 1887, 1897 (and used regularly for worship) are added to the sample accepted, the correlation takes the very highly significant value of ·64, with very highly significant deviations from regression.

AN UNUSUALLY LONG-LIVED DUST DEVIL AT POONA ON THE 27th MARCH 1942

BY

P. K. RAMAN

(Agricultural Meteorology Section, Meteorological Office, Poona)

A DUST devil was observed to persist from about 12·00 hrs. to 15·45 hrs. I.S.T. near the Central Agricultural Meteorological Observatory at Poona on the 27th March 1942. Fig. 1 shows a map of Poona and its environs; the track of the dust devil is shown by the dotted line. On the right hand side may be seen the confluence of the two rivers Mutha and Mula. 'O' is the position of the Observatory from which the dust devil was continuously under observation. The position of the dust devil at different times during its unusually long life is indicated by the letters A, B, C, D and E in Fig. 1.

At 12 noon the dust devil appeared at the point A. Its diameter was apparently about 20 to 30 ft. and its top at an elevation of about 20° to 25°. During the interval 12·00 hrs. to 14·45 hrs. the dust devil moved very slowly from the point A to the point B which is about two miles due north of the Observatory. During its passage from A to B, a distance of two miles *across* the line of sight, the dust devil might have moved slightly at intervals *along* the line

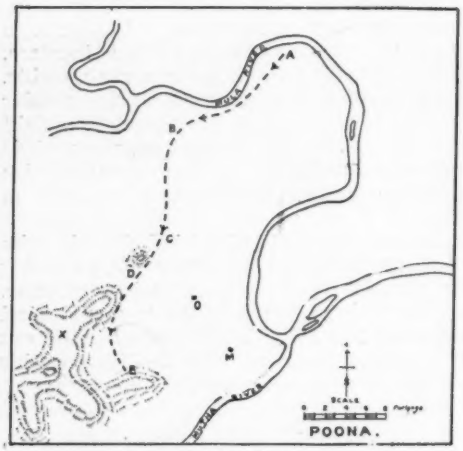


FIG. 1

of sight, but it was not possible to make any correct estimate of such movements. As it approached the position B the base of the dust devil appeared very much like a dark pillar of smoke rising out of a fire. Later, it was verified that at this point dust from a coal dump was caught up by the whirl-wind. The appearance of the dust devil during the stage AB is shown by the photographs *a*, *b*, *c*, *d*, *e* and *f* respectively taken at the time intervals indicated in Fig. 2. At about 3 p.m., while watching from the 35 ft. tower at the Observatory the dust devil was seen suddenly to gain in momentum and to move faster than before in a southerly direction. By now, the colour had changed from dark to the usual brown colour. The elevation of the top of the dust devil was now as much as about 70° above the horizon. The upper portion had also spread out, obscuring the sun for nearly 15 minutes (Fig. 2, *g*). The whirl-wind now rapidly moved in a southerly direction towards the point C. While near C, a huge galvanised iron sheet was seen to be torn off from the roof of a temporary shed. Soon after, this sheet came down and hit the ground with a loud noise. Tiles from other neighbouring sheds were also seen to fly up and fall to the ground. The whirl was now at its minimum distance from the Observatory with its direction of rotation clock-wise (Fig. 2, *h*, *i*). Then the dust whirl moved towards the hill, marked D in Fig. 1. At this place the whirl was about 40 to 50 ft. in diameter. It then split temporarily into two distinct whirls but later fused again into a single whirl with its fury slightly abated (Fig. 2, *j*, *k*, *l*).

Afterwards the whirl moved from the position D to the position E near the Fergusson College along the foot of the hill marked X in Fig. 1. The dust devil was visible till about 15·45 hrs. when it appeared to die out somewhere near the point marked E on the map.

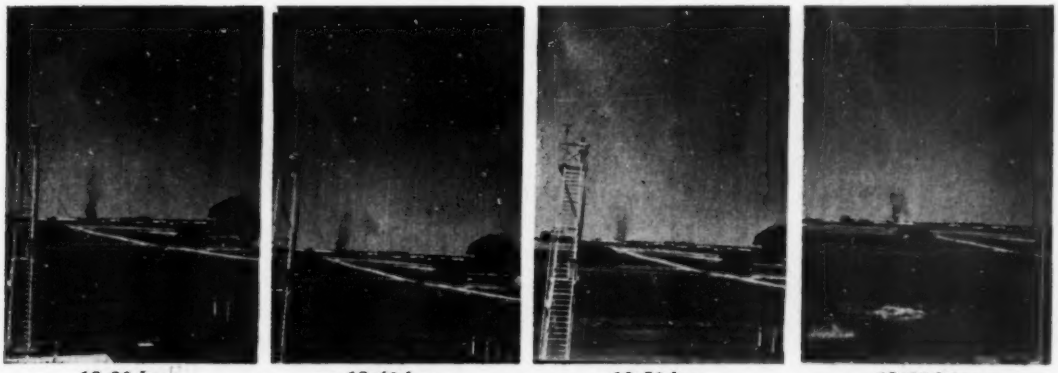
An estimate of the height of the dust devil may be made from (i) the horizontal distances from the point of observations measured with the help of a big map of Poona and (ii) the altitude or the vertical angle of the top of the revolving column. Table I gives the approximate location, horizontal distance from the Observatory, angle subtended and the estimated height of the dust whirl in feet assuming that the "devil" was vertical. As the upper wind direction was from NNE, *i.e.*, from the "devil" towards the observer, the height calculated is likely to be an overestimate especially when the distance was small.

TABLE I

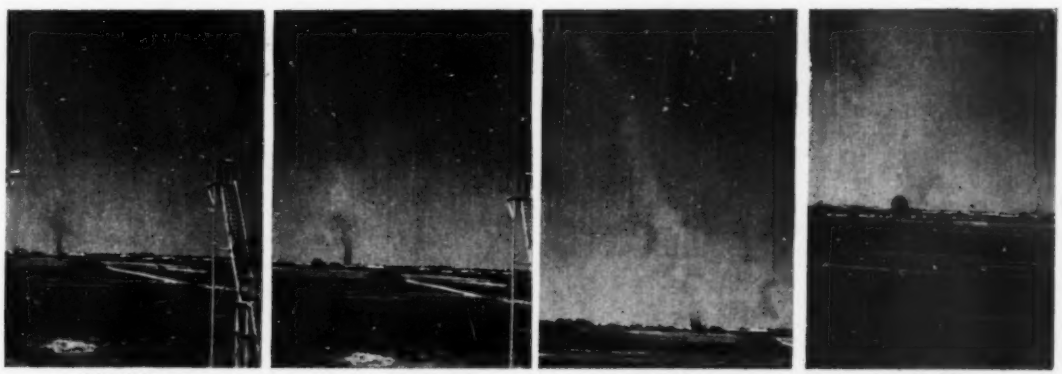
Approximate location as given in Fig. 1	Horizontal distance from the Observatory	Angle subtended	Estimated height in feet
A	24 to 30 fur.	20°	5200–5900
B	16 to 18 fur.	30°	6000–6900
C	9 furlongs	60°	9900
D	6 furlongs	70°	10600

Table II gives the temperatures observed with an Assmann Psychrometer at about 13·30 hrs. on the 27th March in the "open" at the Central Agricultural Meteorological Observatory. Lapse rates calculated from these observations are also given in the table.

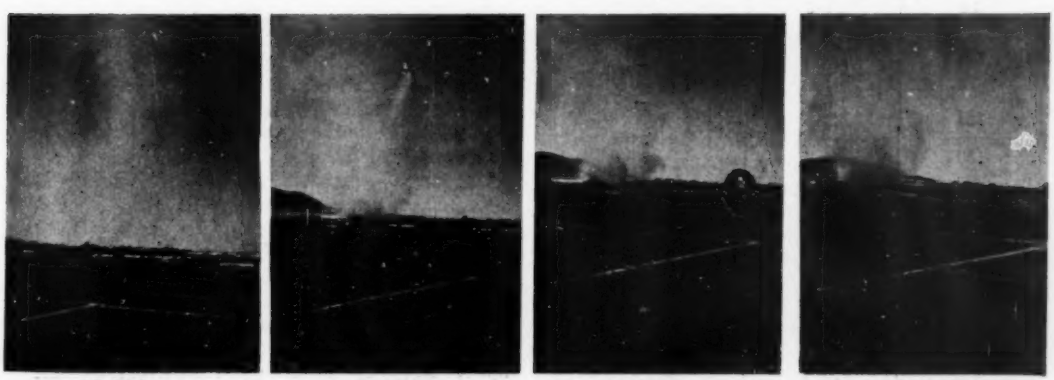
Fig. 3 is a reproduction of the Dines Pressure Tube anemogram recorded at the top of the 120 ft. tower of the Meteorological Office marked M in Fig. 1. During the interval 10·00 to 16·30 hrs. the air movements were more or less of the thermal



12·30 hrs. *a* | 12·40 hrs. *b* | 12·50 hrs. *c* | 13·30 hrs. *d*



14·00 hrs. *e* | 14·30 hrs. *f* | 14·45 hrs. *g* | 15·00 hrs. *h*



15·20 hrs. *i* | 15·25 hrs. *j* | 15·27 hrs. *k* | 15·30 hrs. *l*

FIG. 2

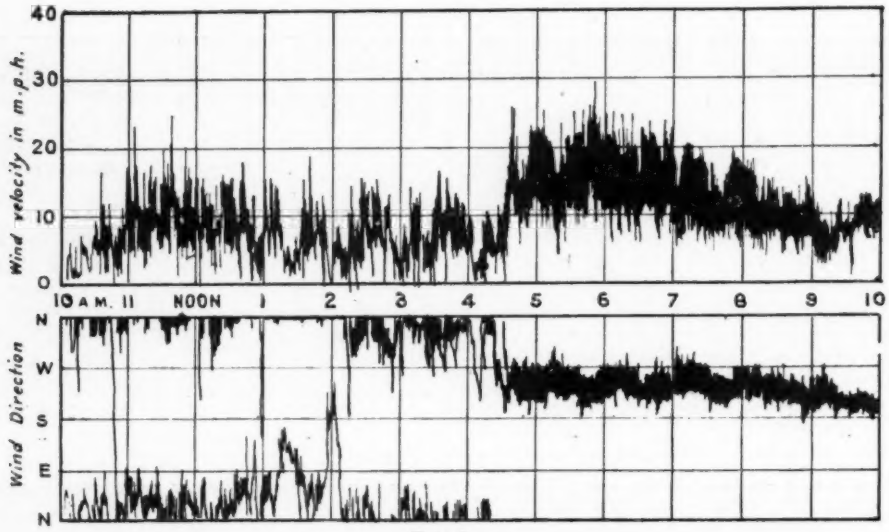


FIG. 3

TABLE II

Height in cm. above ground	Temperature in °C.	Lapse rates expressed as number of times the adiabatic lapse rate [0·987°C. (1°C. approx.) per 100 m.]
Surface	69·0	
		218000
1·0	47·2	
		15000
2·5	45·2	
		4400
7·5	43·0	
		1330
15	42·0	
		130
30	41·8	
		330
60	40·8	
		—
90	41·0	
		—
120	40·8	
		67
180	40·4	
		100
240	39·0	
		50
300	38·7	
		—
450	38·7	
		40
600	38·1	
		—
750	38·1	
		—
900	38·1	
		13
1050	37·9	

convective type with a northeast to southeast direction and comparatively low velocity (5 to 10 m.p.h.). We have already indicated in Table II the extremely high lapse rates in the air layers near the ground. The dust devil was in the convective layer throughout its life. The pilot balloon let off at the Meteorological Office in the afternoon indicated a rate of ascent of the order of 10·5 km./hr. while that indicated by the free lift of the balloon was only 9·0 km./hr. From Fig. 3 it will be seen that at 16·30 hrs. a strong sea breeze from a west-southwesterly direction set in.

The wind velocity at the Meteorological Office Tower from noon to 4 p.m., before the westerly sea breeze set in, was of the order of 5 to 10 miles per hour. The pilot balloon observation on the same afternoon indicated that the wind direction and velocity upto about 2 km. were approximately NNE and 10 miles per hour respectively. Thus although the general drift of the dust whirl was in the same direction as that of the wind upto 2 km., its velocity was only 1/10 to 1/5 of the mean wind velocity, which is surprisingly small.

A detailed study of dust devils is being made at the Central Agricultural Meteorological Observatory where conditions are favourable for observation and correlation with the other meteorological factors. A detailed report of the work done during this summer will be presented later on.

OBITUARIES

RAI BAHADUR SARAT CHANDRA ROY (1871–1942)

SARAT CHANDRA ROY was born at Calcutta and was educated for the legal profession which he entered in 1897. Early in his career Roy was struck by the amount of injustice done to tribal people, in spite of best intentions, by judges and magistrates and police officers of all grades who depended upon touts and interpreters while their ignorance of the tribal language and culture often proved an insuperable barrier to any understanding of the tribal point of view. With a strong determination to serve the tribal people, Roy learnt the language of the Mundas and through it, he recorded the various details of their tribal organisation, economic life, laws of succession and inheritance and their religious life. The publication of *The Mundas and their Country* in 1912 distinguished Roy as an authority on the Mundas and the young lawyer-scientist was now encouraged by the administration of Bihar and Orissa to pursue his investigations. With the financial help given him by the Government from time to time, he published several monographs on the tribes of Chotanagpur and adjacent areas. His monograph on the Oraons was published in 1916, that on the Birhors in 1925 and the Oraon Religion and Customs in the year 1928. In 1935, he published his monograph on the Hill Bhuiyas of Orissa and two years later, in collaboration with his son, Mr. R. C. Roy, whom he had trained up in the methods of field investigation, he published two sumptuous volumes on the Kharias, a little-known jungle tribe of Chotanagpur, Central Provinces and Orissa. Dr. R. R. Marett who wrote a brilliant introduction to this work, described it as a 'model how such research should be conducted'.

With a facile pen and a literary style Roy enlarged his scope of studies. In the Bihar and Orissa Research Society's Journal, he opened up new ground on the archæology of his Province. He has explored many prehistoric sites in Chotanagpur of what are locally known as 'Asur' sites. Although he did not find any human remains from these sites, the stone implements polished and otherwise, cornelia beads, wheel-made pottery, copper and bronze tools and implements, cinerary urns, phallic symbols and such other objects were dug out in plenty and have made the Patna Museum a rich store of pre-historic antiquities. His own house at Ranchi is a rich museum of rare specimens which give inspiration for antiquarian research to local students and inquisitive visitors. Roy's knowledge of physical anthropology was admirably outlined in his Patna Readership Lectures and later on published as 'Principles and Methods of Physical Anthropology', a brilliant exposition which has elicited unstinted praise from experts.

Students of Indian anthropology are deeply indebted to Mr. Roy for the light he has thrown on the past and present culture of the Chotanagpur plateau. He has played a most distinguished role in the development of anthropological thought in India, and had greatly advanced the science of man and its popularity. Roy was never tired of reiterating the importance of anthropological studies in India. The indifference to anthropological studies displayed by the administration and the public bodies is a regrettable chapter of Indian education. Towards the later years of his life Roy emphasised the practical value of anthropology in the promotion of human welfare. He has indicated how a systematic study of the social organisation and religious system, customs, habits and mentality of the people was a necessary preliminary to a satisfactory solution of the special, economic, social and political problems. The study of men of different races and religions, of the customs and manners of one another may help in promoting mutual amity and knitting more closely the bonds of unity between them and thus eventually help to banish much of the communal animosity which is the bane of Indian national life at the present day. Deeply religious as he was, Roy believed that with the realisation of the essential unity of *homo sapiens* which a scientific study of man reveals, the powers of Life, Light and Love would triumph over those of Death, Darkness and Discard and convert our earth into a 'warless creed, a single race and a single tongue'. To this end he worked and towards the end of his career, a significant

change in his anthropological outlook took place and he veered more and more to the functional standpoint.

Roy died ripe in years and rich with honours. A week before his death, a Volume of Essays was presented to him by the well-known anthropologists of India as a token of their grateful recognition of his services to the cause of Indian anthropology. In 1920, he was elected an Honorary Fellow of the Folklore Society of London. He was elected President of the Anthropology Section of the Indian Science Congress for the year 1920 and the President of the section of Anthropology and Folklore of the All-India Oriental Conference in 1932 and again in 1933. He was a foundation-Fellow of the National Institute of Sciences in India and also a member of the Senate of the Patna University. For more than two decades, Roy had edited the Quarterly Journal of Anthropology, *Man in India*. In 1913, he was awarded the Kaiser-i-Hind Medal for literary and public services and the title of Rai Bahadur was conferred on him in 1919. He represented the aboriginese of the Ranchi District for successive terms in the Bihar and Orissa Legislative Council and was a member of the Provincial Committee that sat with the Indian Statutory (Simon) Commission and also the Indian Franchise Committee (Lothian Committee). On the 30th of April 1942, ended the useful career of this distinguished scientist whose researches have raised the status of Indian anthropology and have ensured him great fame in its annals.

D. N. M.

MR. M. VENKATANARANAPPA

IT is with deep regret that we record the death of Mr. M. Venkatanaranappa, Chairman, Mysore Iron and Steel Works, on Saturday, the 30th May 1942, at his residence in Bangalore. Mr. Venkatanaranappa, apparently in good health, was at work and carried through his normal round of engagements even on the day prior to his demise and his passing away, quietly in his sleep, of heart failure, came as a great shock to his relatives and a wide circle of friends.

Mr. Venkatanaranappa who came of an old Mysore family settled on land in the Kadur District was born in 1891; after his early education at Chickmagalur, he graduated from the Christian College, Madras, securing a first in English. He then joined the Madras Law College but before taking a Law degree, Mr. Venkatanaranappa won the second place in the competitive examination of the Mysore Civil Service which he entered as a probationer in 1914. He had the normal service career of a Civil servant till 1921 when he was selected for being trained in the administrative and accounts section at the Tata Iron Works, Jamshedpur. On his return, he was posted as Accountant at the Mysore Iron Works, Bhadravati, which had just been born and which, in the eyes of its critics, looked none too robust an infant. Thus began Mr. Venkatanaranappa's association with Mysore industrial enterprise—an association which during the next twenty years was productive of such fruitful results. Mr. Venkatanaranappa was later appointed General Manager at Bhadravati till 1934 when he became Development Secretary to Government, and during the succeeding five crowded years, Mr. Venkatanaranappa was intimately associated with the launching of several new concerns in the State for the manufacture of steel, chemicals, paper, cement, silk, ferro-alloys, implements, matches, machine tools, etc., and for further developing other industries already established. In 1939 he became the Chairman of the Mysore Iron and Steel Works. He was also associated with a number of other concerns either as Chairman, or Director. He took a leading part in the negotiations preceding the formation of the Hindustan Aircraft Ltd., on whose Board he represented the interests of the Mysore Government. He also represented the State at a number of Conferences convened by the Government of India on industrial matters and notably at the Eastern Group Conference for gearing industrial effort to war needs.

Thus, although Mr. Venkatanaranappa was intimately associated with many of Mysore's industrial enterprises, some of which he helped to bring into being, his name will be long and specially associated with the Mysore Iron and Steel Works to which he devoted the best part of his life. He was one of the pioneers who nursed this great enterprise through its rather delicate infancy, and its teething troubles on to its vigorous and promising manhood. It looked as though the Works would be closed before they had a chance to be properly born, so to speak. Mr. Venkatanaranappa was

amongst those who saw clearly that more than the mere future of the Iron Works was at stake and the acceptance of failure meant that the very industrial policy of the State would be challenged and all industrial enterprise stifled for many years to come. It is not easy now to appreciate the hurdles that had to be cleared in the first years; technical difficulties, the normal concomitant of any big and new enterprise especially as the experiment of running a blast furnace on charcoal was unique in this part of the world; others again, like the economic collapse the world over, following the last War which hit all industries and all countries alike and over which Mysore had, naturally, no control; and, finally, and perhaps the most difficult to bear, was the criticism, sometimes very strong and often ill-informed, which was levelled at the Works by public opinion in the State which as yet had no experience of the running of heavy basic industries. When the early years did not bring the financial results that were almost taken for granted, impatient criticism gave place to almost a clamour for closing down the Works and in those dark days, Mr. Venkatanaranappa ranged himself on the side of those who with vision, robust optimism and uncommon courage, insisted on carrying through the enterprise in the larger interests of the State. Mr. Venkatanaranappa happily lived to see this confidence justified.

Although Mr. Venkatanaranappa had no formal training in science at his University, he was a votary of science, who believed and practised in scientific method and research. He was a voracious reader and this wide reading coupled with the knowledge he gained in the hard school of experience gave him an intimate knowledge of the many industries he was connected with. Moreover, he believed, long before it was the fashion to do so, in industrialisation and in the capacity of his fellow-countrymen to organise and run industrial enterprises. Many were the schemes of research he initiated at Bhadravati and many were the young men of science whom he started on useful careers. He actually showed what could be done even under the undoubted handicaps of which he was only too well aware of. All these traits won for him the confidence not only of Government but of Indian industry, several of whose leaders all over the country were his personal friends. And no one could wish for a kinder, more generous or more loyal friend; sensitive, witty and brilliant in conversation he also had a rare sense of humour. Indeed, no one laughed more merrily than he when the facetious made obvious jokes at this gentleman of generous proportions being connected with the Development Department and the heavy industries.

Mr. Venkatanaranappa died in harness. His untimely death terminated a career which with the solid achievements behind it, held promise of even greater usefulness to the State. A large number of friends and admirers mourn the loss of a gentleman whose name is woven into the warp and woof of the pattern that is and that will be for some years to come of Mysore's industrial enterprise.

MR. M. SESHA IYENGAR, M.A.

IT is with deep regret that we record the death of Mr. M. Sesha Iyengar on the 30th of May 1942 at Bangalore. Mr. Sesha Iyengar was born in 1891 and after graduating from the Central College, joined the teaching staff of the Chemistry Department of the College in 1914. His remarkable administrative capacity was duly recognized when in 1928, with the starting of the Intermediate Colleges, he was appointed the Superintendent of the College at Bangalore —an institution of over a thousand students. He held this post, which carried with it the status of a Professor, till his death.

Mr. Sesha Iyengar was prominently associated with the teaching of chemistry at the Central College and was recognized to be a very capable teacher. Though his administrative duties took up most of his time, he was keenly interested in research —his main contribution being a Study of Substitution in Resorcinol Derivatives.

Mr. Sesha Iyengar was always enthusiastic about sports. As an undergraduate he played football. Later, he was keen about tennis, in which he won several trophies— the last, barely three months before his death.

By his death, the Mysore University has lost a capable teacher and a very efficient administrator. B. S.

LETTERS TO THE EDITOR

CONSTITUTION OF ANOLOBINE

In a previous communication[1] the synthesis of *dl*-2, methoxy-5, 6, methylene dioxy- nor-aporphine was announced. Since then small amounts of anolobine (60 mg.) and anolobine O-methyl ether (30 mg.) have been received from Dr. Manske of the National Research Laboratories, Canada. The synthetic base being racemic was unsuitable for direct comparison with anolobine O-methyl ether which is lævorotatory. Racemisation of the natural alkaloid was not feasible as the amount available was too small for the process to be successfully carried out. The yield of *dl*-2, methoxy-5, 6, methylene dicxy- nor-aporphine from 2, amino-5 methoxy-6, 7, methylene dioxy, 1, 2, 3, 4, tetrahydro-isoquinoline through the Pschorr reaction was only about 5 per cent, and a sufficient amount of the aporphine could not therefore be accumulated to attempt a resolution of the optically inactive synthetic base.

Recourse was therefore had to the elegant method of Gadamer[3] in which, by treating both the synthetic and the natural bases with ethyl chloro-carbonate and alkali, products were obtained in which the nitrogen ring was cleaved and the centre of asymmetry destroyed. Both these products, being optically inactive, become comparable.

The synthetic base on treatment with ethyl chloro-carbonate and alkali yielded a solid which, after two crystallisations from alcohol and a third from 50 per cent acetic acid, melted at 169-170° C. (Prisms).

By a similar treatment with ethyl chloro-carbonate and alkali, Manske's anolobine O-methyl ether yielded a solid which, after three crystallisations (the last from 50 per cent acetic acid), melted at 245-247° C. (colourless sheaves of long needles).

The two products when mixed melted to a clear liquid between 220-230° C. after shrinking to a tiny dot at 160° C.

It appears therefore that anolobine cannot be represented by the structure assigned to it by Manske.[2]

My grateful thanks are due to Dr. Manske for his gift of anolobine and anolobine O-methyl ether and to Professor B. B. Dey for his guidance and keen interest in the work. Full details of this investigation will be published in due course elsewhere.

T. R. Govindachari.

Presidency College,
Madras,
May 30, 1942.

[1] Govindachari, *Curr. Sci.*, 1941, **10**, 76.
[2] Manske, *Can. J. Res.*, 1938, **16**, 76.
[3] Gadamer, *Arch. Pharm.*, **259**, 146.

TOXICITY OF MUSTARD OIL SAMPLES PREPARED FROM MUSTARD SEEDS AND CAKES UNDERGOING MICROBIAL DECOMPOSITION

In a recent communication the present author[1] reported that it was possible to prepare mustard oil samples from argemone-free mustard seeds and cakes undergoing microbial decomposition, resembling in physical and chemical properties samples of mustard oil reputed to have produced symptoms of epidemic dropsy in man. He[2] has also shown that three proved potent samples of mustard oil obtained from Lal did not contain argemone oil—the causative factor suggested by Lal, Chopra and others—even in a concentration of 0·75 per cent.

However, if the microbial decomposition theory be correct then the oil samples prepared from decomposed mustard seeds and cakes should, in the first instance, prove toxic to animals. With this end in view some feeding experiments were carried out and a summary of the effects observed is given here.

Twelve growing albino rats were used, nine in the experimental series and three in the control group. The experimental rats were given a daily dose of mustard oil both expressed and extracted from fungus-decomposed mustard seeds and cakes whereas the control ones received equal amounts of pure 'ghani' mustard oil. The animals in the experimental group showed very soon a sickly appearance with considerable loss of fur and subsequent loss in body weight. Of the nine animals, six died and three killed at intervals to study the progressive changes in tissues, if any. The control animals behaved in a more or less normal manner and there was a gradual increase in body weight. One control rat while maintaining a good growth suddenly developed peritonitis with intestinal obstruction and died on the fiftieth day. The other control rats were killed at intervals to serve as standards for comparison.

The heavy mortality in the experimental group coupled with definite histological changes in some tissues of these animals reported by Sen (elsewhere in this issue) indicates that mustard oil samples prepared from decomposed mustard seeds and cakes are fairly toxic. In this connection some findings of Lal appear to be very significant. While experimenting with rats he and his co-workers[3] observed that 'a supply of mustard oil, which had been incriminated on epidemiological grounds, proved *toxic* to rats in as much as *it caused reduction in weight and early death*'. In the case of cats they[4] observed that *in 5 per cent. argemone oil group none died whereas there was heavy mortality in the Rangpur oil group (dropsy-positive mustard oil) and five out of six cats died.* Full details of the present investigation will be published elsewhere.

My best thanks are due to Dr. T. N. Sen, M.B., for kindly carrying out the post-mortem and histological examinations. I am also grateful to Prof. S. N. Bose, F.N.I., and Prof. J. K. Chowdhury, F.N.I., for their kind interest.

S. N. Sarkar.

Biochemical Laboratory,
University of Dacca,
June 3, 1942.

[1] Sarkar, *Ann. Biochem. Exp. Med.*, 1941, **1**, 325.
[2] —, *Ibid.*, 1941, **1**, 271.
[3] Lal, et al., *Ind. Jour. Med. Res.*, 1941, **29**, 168.
[4] —, *Ibid*, 1941, **29**, 183.

POST-MORTEM AND HISTOLOGICAL CHANGES IN SOME TISSUES OF RATS FED ON MUSTARD OIL SAMPLES PREPARED FROM MUSTARD SEEDS AND CAKES UNDERGOING MICROBIAL DECOMPOSITION

On the suggestion of Dr. S. N. Sarkar, post-mortem and histological examinations of various tissues of animals subjected to his mustard oil tests were carried out by me and the important changes noticed are summarised below.

Morbid Anatomy.—The liver showed marked congestion in all the experimental animals and in a few cases, some hæmorrhagic spots or patches were noticed. In the control series very slight congestion of liver was observed.

Congestion of lungs in varying degree was present in all the experimental rats. In one

case a solidified patch, whitish in colour, was observed at the lower pole of the lower lobe of each lung. While sectioning through these solidified patches a thick whitish gelatinous matter came out. Very little congestion was noticed in the control series.

In the heart of the experimental animals, the ventricles were all empty and the auricles (specially the right), the superior vena cava and the inferior vena cava were distended with accumulation of dark blood. In some, the coronary blood vessels were somewhat engorged. In one case there were also some sub-pericardial hæmorrhages. The control series, however, showed no appreciable change.

In the experimental series no noticeable change in kidney in earlier stages could be seen but in later stages it showed some congestion. In the control series there was practically no change.

In the spleen of the experimental animals slight congestion could be noticed in later stages whereas in the control group no such change could be noticed.

The skin in some of the experimental animals was studied and the blood vessels of the ear appeared to be a bit more prominent than those in the control series. In the abdominal skin the cutaneous blood vessels could not properly be examined due to the part being thickly covered with hair.

One control rat which unexpectedly died showed much congestion of the intestines with some unstained peritoneal fluid and intestinal obstruction in the lower part of the ileum. The intestinal coils above the site of obstruction showed undue distension of the gut. As this rat died of some intercurrent disease so the changes in different organs were not taken into consideration.

Morbid Histology.—The liver in all the experimental animals showed considerable dilatation and engorgement of the sinusoids, central intralobular vein and branches of portal vein. In some cases the liver showed degenerative changes also. In the control series, the liver, in some cases, showed slight congestion but it was practically negligible in comparison with that of the experimental series. The extravagation of blood was not noticed in any case and the hæmorrhagic areas in the morbid anatomical examination were due to extreme vascular dilatation.

Lungs in all the experimental animals showed dilatation and engorgement of alveolar capillaries with blood and cellular exudate and in one some granular exudate with a few cells in the alveolar spaces thus obliterating and filling up partially or completely some of them. In two cases lungs showed marked congestion with blood and leucocytes infiltration resulting in many of the alveoli being completely blocked with red blood corpuscles and white blood corpuscles. In the control series no such marked changes could be noticed.

In the experimental series the heart showed some engorgement of vessels in between the muscle fibres. In one case the section showed some engorged dilated vessels in sub-pericardial tissue. In the control series no pronounced change was noticeable.

The kidney in the experimental rats showed very little or no congestion of the glomerular capillaries at earlier stage of the experiment but in later stages it showed definite and marked congestion of glomerular and intertubular capillaries. In the control series, however, very slight glomerular congestion, if at all, could be noticed.

In the spleen of the experimental rats some degree of congestion was noticed at a later stage whereas in the control ones no such change was observed.

In the skin of some of the experimental animals there was some degree of vascularisation of the corium with young dilated capillaries and perivascular infiltration in some cases. In one where the abdominal skin was examined some engorged blood capillaries in the subcutaneous fatty tissue were observed. In the skin of the control series no marked vascularisation was present.

These findings together with the result of feeding experiments reported by Sarkar (elsewhere in this issue) suggest that mustard oil samples obtained from mustard seeds and

cakes undergoing microbial decomposition are definitely toxic. Full details will be presented elsewhere.

My best thanks are due to Dr. S. N. Sarkar for kindly supplying the materials used in this investigation. I am also grateful to Prof. S. N. Bose, F.N.I., and Prof. J. K. Chowdhuri, F.N.I., for their kind interest.

T. N. Sen.

Physiological Laboratory,
University of Dacca,
June 3, 1942.

NON-HERITABLE POLYEMBRYONY IN *ANDROPOGON SORGHUM*

The reported cases of polyembryony in crop plants fall into two groups, those in which the character is inherited as instanced in the case of citrus,[1] rice,[2] cotton,[3] etc., and others in which it is not hereditary.

The following is an example of the non-hereditary type of twinning observed in *Sorghum*. For the past seven years annually a few thousand seedlings of *Sorghum* of the *bilichigan* and other varieties have been raised individually in enamel dishes in connection with an investigation on *Striga* attack on *Sorghum*. On three occasions twin seedlings were obtained from individual seeds. In each of the three cases one of the two embryos developed into a seedling, which was bigger and more vigorous than the other seedling. The root systems of the two corresponded in vigour with their aerial parts; the roots of the weaker of the twins was slenderer and less branched (Fig. 1). Of the three twins one was accidentally destroyed, while in another the twin seedlings were planted separately and grew for some time and then both died. Both seedlings of the third grew to maturity and observations on this forms the subject of the present note. The twin seedlings shown in Fig. 1 were transferred without being separated, to a 12-inch earthen pot containing good garden soil mixed with farmyard manure. The vigorous and weak plants were separately labelled and all through their life the difference in vigour was found maintained. Even the inflorescence of the less vigorous plant was smaller though the seeds of both were of the same size. Selfed seeds

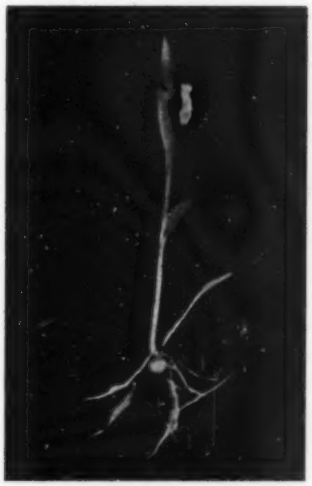


Fig. 1

of the two were collected separately. The following table gives the results of the progeny test in respect of the twinning habits:—

Character of plant	Total No. of seeds	Seeds germinated	Seeds that died	Single seedlings	Twin seedlings
Vigorous	532	495	37	495	0
Weak	131	69	62	69	0

Although the twins showed considerable difference in their size and vigour, they were presumably diploids, since both gave rise to normal progenies.

Reference to literature has shown that the occurrence of any type of twinning in *Sorghum* has not been reported previously. That only three such cases were observed in thousands of seeds shows that it is of very rare occurrence.

L. S. S. Kumar.

College of Agriculture,
Poona,
May 27, 1942.

[1] Frost, H. B., *Hilgardia*, 1926, **1**, 365 (cited by Webber[4]).
[2] Ramiah, K., et al., *Ind. J. Agr. Sci.*, 1935, **5**, 119.
[3] Webber, J. M., *J. Agr. Res.*, 1938, **57**, 155.
[4] —, *Bot. Rev.*, 1940, **6**, No. 11, 575.

FALSE POLYEMBRYONY IN VIVIPAROUS *RHIZOPHORA MUCRONATA* LAM.

Rhizophora mucronata Lam., is a mangrove plant which bears fruits with viviparous seeds. Before the fruit becomes detached from the parent tree, the single seed inside germinates and by growth of the cotyledons and later enlargement of the hypocatyl, which pushes out through the micropyle, the lower part of the embryo is formed into a club-shaped structure 10" to 20" long. When the fruit drops down into the swamp surrounding the plant, the root-end penetrates the mud and gets established by development of the main and lateral roots. If the fruit drops down during high tide, when the swamp is usually flooded, the seedling may be carried away by the tide and gets established later.

In *Rhizophora mucronata*, the most common occurrence is that of fruits each bearing a single well developed hypocotyl indicating the presence of one normal embryo. The specimen illustrated on the right in the photograph (Fig. 1) was collected from the saline swamps of Bandra Creek near Bombay. The unusual feature of this specimen is the presence of twin hypocotyls emerging from a single fruit. As normally only one seed is formed in a fruit in *Rhizophora*, from an external examination of this specimen, it seemed that two embryos had developed from the same ovule. When the pericarp enveloping the plumular part was carefully dissected it was observed that each of the twin hypocotyls was connected with its own separate plumule and also enclosed by separate nucellar tissue, tegmen and other tissues of two distinct ovules which, however, were more or less adhering to each other. So this is a case of false poly-embryony of the type recently reported by Howard in *Brassica*. A large number of fruits were dissected out and only in another case we found the presence of a second ovule with its young embryo.

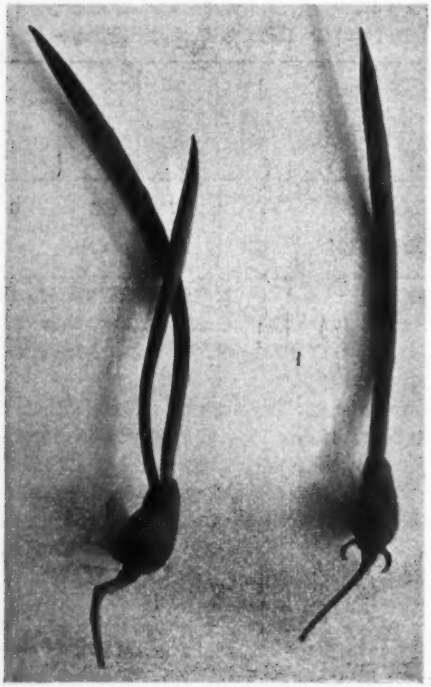


FIG. 1

Photographs of normal (on left) and abnormal fruits of *Rhizophora mucronata*

L. S. S. KUMAR.
W. V. JOSHI.

College of Agriculture,
Poona,
May 26, 1942.

[1] Howard, H. W., *J. Genet.*, 1939, **38**, 325.

BALANOGLOSSUS AS FOOD OF FISHES*

SRI. S. VARADARAJAN recorded for the first time on 6th July 1940 and 1st August 1940 that the Whiting *Sillago sihama* and the Squeaking Perch *Therapon jarbua* had a specimen of Balanoglossus in their stomach contents. This led to the present investigation.†

A systematic collection of fishes from both the 'Balanoglossus area' and the Watchman's Bay was arranged. The fishes were caught by

* Published with the permission of the Joint Director of Industries and Commerce, Madras.

† As Sri. S. Varadarajan, M.A., was transferred to West Hill Biological Station, Malabar, on 11-9-1940 he could not pursue this item of research.

stake-nets 1½′ high, planted within the shore during the low tide, especially during the New Moon and Full Moon days. During the high tide, water with its finny inhabitants flows above and over the net; but when the tide recedes most of the fishes are trapped in the net. The following four species of fish are generally represented in the catches made by this method:—(1) the Whiting, *Sillago sihama*, (2) the Mullett, *Mugil waigiensis*, (3) the Mullett, *Mugil troschelii*, and (4) the Squeaking Perch, *Therapon jarbua*.

The stomach-contents of the above fishes were studied in detail; and the following observations were recorded:—

(1) *Sillago sihama* (125 specimens).—Polychæte worms, crabs, prawns, stomotopods, 14 specimens of *Zonogobius* sp.‡ Balanoglossus, amphipods, sea-weeds and sand-grains.

(2) *Mugil* spp. (200 specimens).—Moults of polychæte worms, copepods, amphipods, Thalassiothrix, Bacteriastrum, Rhizosolenia, Trichodesmium, Nitzschia, Pleurosigma, Fragilaria, Algal filaments and sand-grains.

(3) *Therapon jarbua* (25 specimens).—Polychæte worms, crabs, 14 specimens of *Zonogobius* sp., prawns, stomatopods, amphipods, Balanoglossus, sepia, fish-scales and sea-weeds.

Of the 125 specimens of *Sillago sihama*, 12 specimens showed Balanoglossus in their stomach, that is, nearly 10 per cent. feed on this worm; similarly, of the 25 specimens of *Therapon jarbua* examined, 3 specimens had Balanoglossus in their stomach, that is, 12 per cent. favour this diet. Balanoglossus is therefore not a general item of food of these fishes. In spite of these enemies, no reduction in the population of Balanoglossus has been noticed. Thanks to the comparative freedom the bed of Balanoglossus—being in the tidal zone—enjoys, sea-water can cover it only during the high-tides, twice during 24 hours. The two fishes in question are, therefore, deprived of access to the bed at low tides; their ravages can only be intermittent and in a pell-mell fashion as they have to retire with the ebbing tide. It is also likely that the fecundity of these worms copes with the destruction caused by these fishes and that the balance of nature is in favour of the Balanoglossid worms.

From the detailed study of the stomach-contents, it is seen that Balanoglossus is not an item of food of the mullets though they are caught in the area along with the Whiting and the Squeaking Perch. The snout of the specimens which had fed on Balaniglossids smells of iodoform. Balanoglossids swallow sand, and their intestine is almost always filled with sand. The above fishes when they feed on Balanoglossids, naturally swallow sand-grains also. Further, to get Balanoglossids and polychæte worms, the fishes probably have to dig into the sand with their snout.

During the investigation, we were confronted by the following problems:—What originates the iodoform smell? If Balanoglossus is responsible for it, can it be a protective device as iodoform has a disagreeable smell or is it a disinfectant employed by Balanoglossus for coating its burrows with, or can it be a product of the gut of Balanoglossus which, like the earthworm, swallows earth (sand) and throws it out as fæces? The substratum in the Balonoglossus area is subject to the gut-action of these worms all over there.

D. W. Devanesen.
P. I. Chacko.

Krusadai Biological Station,
Gulf of Manaar,
March 19, 1942.

‡ It was not possible to determine the species as the specimens had been partly digested,

FOOD AND FEEDING HABITS OF THE OIL SARDINE AND MACKEREL

Devanesen in an article in this *Journal*[1] has made some valuable observations regarding the food of certain commercially important fishes of the west coast.

A study of the food and feeding habits of

the shoal fishes of the Trivandrum coast in relation to the plankton distribution has been carried on by one of us (M. A. S. M.) since July 1938[2] and our observations in regard to certain points dealt with by Devanesen are at variance with his.

About the food of the oil sardine (*Sardinella longiceps*) and the mackerel (*Rastrelliger kanagurta*), Devanesen observes, "Recent researches have revealed that both the oil sardine and the mackerel regularly and normally feed on fish eggs occurring in the plankton". On the Trivandrum coast mackerels appear in large shoals during September to November and March to May, and oil sardines during September to November. The analyses of several samples[3] of the gut contents of these two fishes during the course of our investigation show that they are essentially phytoplankton feeders, the chief and common items in their dietary being diatoms like *Coscinodiscus, Rhizosolenia, Thalassiothrix* and *Pleurosigma*; and dinoflagellates like *Peridinium, Ornithocircus, Dinophysis, Peridiniopsis* and *Ceratium*. Radiolarians, larval bivalves, *Evadne*, copepods (mainly *Temora*) and their nauplii also form common items of their food. The mackerels of this coast are often found to feed on macroplankton organisms such as Leucifers, Mysids, *Acetes* and other crustaceans, besides polychætes and fish fry. These are not, however, regular constituents of the food of the oil sardine. Fish eggs have never been noted in the gut contents of these fishes whereas Devanesen has recorded them as a regular item in the dietary of the mackerels and oil sardines of the Calicut coast.

He has also stated that the blue green alga, *Trichodesmium* found in the plankton off Krusadai in great abundance during certain seasons forms a favourite item of food of the Indian Sprat *Sardinella gibbosa*. On the Trivandrum coast large patches of *Trichodesmium* appear in the inshore waters at intervals during December to April, and its occurrence is found to have an inhibiting influence not only on the plankton feeding fishes, but also on certain other plankton organisms themselves. None of the plankton feeding fishes of this coast is found to graze on these patches of *Trichodesmium*, though on a single occasion, on 18th April 1940, three specimens of *Clupea atricauda* examined had plenty of these alga in their gut contents. But judging from the normal feeding habits of this fish observed during the course of our investigation, this is to be taken merely as exceptional. Such instances of indiscriminate feeding have occasionally been noted in other fishes also.

It may also be noted in this connection that the quantities of oil sardines and mackerels landed annually in the fishing villages to the north of Quilon in central Travancore, are considerably greater than the catches obtained to the south of Quilon. This difference in the distribution of the shoals is, then, to be correlated with the difference in their feeding habits. But recent food analyses conducted by Mr. K. Gopinath[4] of this Laboratory on the gut contents of oil sardines obtained from various fishing villages to the north of Quilon in Travancore, have confirmed our observations. Considering the fact that the seasonal distribution of the plankton of the Trivandrum and Calicut coasts is almost identical, the dissimilarity in the feeding habits of the same species of fishes common to both the regions, should be attributed to some unknown factor which requires further investigation.

C. C. JOHN.
M. A. S. MENON.

Marine Biological Laboratory,
University of Travancore,
Trivandrum,
May 1, 1942.

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[1] *Curr. Sci.*, 1942, **11**, 142.

[2] A detailed report on this work is under preparation and will be published elsewhere.

[3] Stomach contents of 222 specimens of oil sardine and 572 specimens of mackerel were examined.

[4] Our thanks are due to Mr. K. Gopinath, Assistant Research Officer, for supplying us with the information.

ON THE OCCURRENCE OF CARIDINA (*ATYIDAE, DECAPODA*) IN TRAVANCORE

WHILE engaged on a Faunistic survey of the Decapod crustacea of Travancore, chiefly the prawns of the Penæid and Palæmonaid group, a few species of *Caridina* were obtained from certain localities of this State. Probably this is the first record of the occurrence of this genus in Travancore. The collection consists of the following four species:—

1. *Caridina gracilirostris* de Man.[1]

C. gracilirostris occurs in large numbers among the aquatic vegetation on the border of the Veli lake. Large females collected in July (1939) were found to carry numerous eggs in their brood pouch. The largest ovigerous female in the collection is 35 mm. and the largest male 30 mm. in length.

2. *C. lævis* Heller.[2]

Two collections of this species were made, one in September and another in November 1939, from among the aquatic vegetation in the submerged paddy fields of Kuttanad in central Travancore. The collection includes a number of ovigerous females measuring from 14 to 20 mm. in length. The number of eggs in the different individuals varies from 40 to 60. The eggs of this species are distinctly larger than those of the other species recorded from Travancore and measure about 0·7 to 1·0 mm. alcng the long axis and from 0·4 to 0·5 mm. along the short axis. Live specimens are light brown in colour.

3. *C. nilotica* (Roux) var. *gracilipes* de Man.[3]

Three males, two ovigerous females and three young ones of this variety were collected from Kuttanad in central Travancore. One point of difference, however, to be noted between the present collection and the named examples in the Indian Museum is, that the former are slightly larger, the ovigerous females measuring about 24 mm. and the largest male 21·6 mm. in length. Compared to *C. lævis* this variety appears to be rather rare in Kuttanad. Live specimens are dark brown in colour.

4. *C. weberi* de Man.[4] var.

The Water Analyst of the Wellingdon Water Works, Trivandrum, placed at my disposal a few specimens of this species, which he collected from the water supply mains, in March 1940. The largest male is 13·5 mm. and the largest female 15·5 mm. in length. The collection does not include any ovigerous female.

These specimens are closely allied to the variety '*sumatrensis*'* inasmuch as they possess a number of dorsal teeth on the carapace behind the orbit, and that the palmer portion of the second peræopod is more than half the length of the dactylus.

One noteworthy fact which emerges from the study of the local distribution of these species is that while *C. gracilirostris* is very common in the Veli lake, a small brackish water lake situated three miles north of Trivandrum, it is not found in central Travancore. Similarly, *C. lævis* and *C. nilotica* var. *gracilipes*, the common species of central Travancore, are not found in the Veli lake. This may be due to the fact that the species found in the Veli lake is a brackish water form, while the species found in central Travancore are exclusively fresh water in their distribution. The Veli lake is in direct communication with the sea during certain months of the year and is subject to varying conditions of salinity. But the localities from where *C. lævis* and *C. nilotica* var. *gracilipes* were collected, are purely fresh water areas beyond tidal influence. This difference may probably account for the conspicuous absence of *C. gracilirostris* in central Travancore.

S. NATARAJAN.

Marine Biological Laboratory,
University of Travancore,
Trivandrum,
May 15, 1942.

[1, 2] de Man, *Max Weber's Zoolog.*, 1892, pp. 365-399, text and plates.

[3] —, *Rec. Ind. Mus.*, 1908, **2**, p. 270. pl. 20, figs. 7, 7 *a* and 7 *b*.

[4] Kemp, S., *Ibid.*, 1913, **8**, pp. 305 and 306, pl. 29, figs. 24 and 25, pl. 20, figs. 26 and 28.

* "The variety '*sumatrensis*' was recorded from Sumatra (de Man, 1892) from Engano Island near Sumatra (Nobili, 1900) and from Cochin, China, Siam and environs of Bombay (Bouvier, 1905)."

My thanks are due to the Water Analyst, Mr. P. G. Nilacanta Pillai, B.A., M.Sc., for the collection of *C. weberi*.

ERGOT IN INDIA

I WAS interested to read the note "Ergot in India" published in the November 1941 issue of *Current Science*. It may be noted that the first collection of the Ergot (*Sphacelia sorghi*) on Jowar (*Sorghum vulgare* Pers.) was made at Dharwar by the undersigned in 1915. Later on it was also found on *Andropogon annulatus* Forsk., *Andropogon caricorus* L., *Ischæmum pilosum* Tri., and *Pennisetum alopecuros* Steund.

In the Bombay Karnatak the fungus is quite common on the Jowar crop causing considerable damage particularly in the years when the crop is late sown.

On *pennisetum alopecuros* the dark, sticky, bent selerotia are quite conspicuous.

These have been recorded in the publication *The Fungi of Bombay*[1] and the original samples collected by the writer may be found in the herbarium of the Plant Pathologist, Agricultural College, Poona.

G. S. KULKARNI.

Central Farm,
Gwalior,
May 11, 1942.

[1] Bulletin No. 176 of 1934, Department of Agriculture, Bombay, Poona.

ALTHOUGH it was apparently collected before that date by the above writer, the fungus *Sphacelia sorghi* was first described by McRae in 1917. It is quite different from the fungus found in the Simla hills, having spores 7·6-16 × 4-6 μ, as compared with 3·6-11·0 × 1·8-4·6 μ for the largest collection of spores on the Simla specimens.

G. WATTS PADWICK.

Imperial Agricultural
Research Institute,
New Delhi,
May 30, 1942.

THE FATTY OILS FROM THE SEEDS OF *MOMORDICA CHARANTIA* AND *MOMORDICA DIOICA* (N. O. CUCURBITACEÆ)

THE seeds of *Momordica charantia* and *Momordica dioica* were obtained from villages in the immediate neighbourhood of Kolhapur. The oils from these seeds were obtained in each case by treating the decorticated seeds with carbon tetrachloride in a soxhlet apparatus. The yields have been calculated on the weight of the decorticated seeds. The physical and chemical constants of these oils have been determined and the data obtained are summarized in the Table below.

	Momordica charantia	*Momordica dioica*
Yield of the Oil	.. 35%	40%
Specific Gravity at 25° C.	0·9962	0·9892
Refractive Index at 25° C.	1·4985	1·5170
Acid Number	.. 4·75	2·78
Saponification Value	181·3	186·6
Iodine Value	.. 73·33	72·66
Reichert-Meissel Value	.. 2·52	3·05
Polenske Number	.. 0·62	1·81
Acetyl Value	.. 2·0	7·72
Unsaponifiable Matter	.. 0·6%	0·7%

The oils are green in colour and become rancid on exposure to the air. They have the smell peculiar to the fruits themselves. In carbon tetrachloride solution the oils appear red. The details as well as the subsequent work done will be published elsewhere.

J. W. AIRAN.
S. V. SHAH.

Rajaram College,
Kolhapur,
March 8, 1942.

REVIEWS

The Mechanism of the Human Voice. By Robert Curry. (J. & A. Churchill, Ltd., London), 1940. Pp. viii + 203. Price 10*sh.* 6*d.*

In common with other branches of acoustics, the scientific study of the human voice has acquired a new interest as the result of recent developments in the recording, reproducing, transmission and broadcasting of human speech. Recent advances in science have also given us more efficient methods for observing the movements of the vocal organs in action and for analysing the character of the sounds of speech and song. It is possible, for instance, to observe the movement of the vocal chords in any desired phase of vibration using periodic illumination of which the frequency is controlled by the voice itself. Modern X-ray tubes enable very clear photographs of the larynx and the vocal chords in action to be obtained. Modern microphones and cathode ray oscillographs enable us to make oscillograms of speech and song more satisfactory than those possible with mechanically operated phonodeiks. Methods have also been developed by which the harmonic components of a musical sound may be instantaneously exhibited in the form of a line spectrum. The use of such new techniques has brought on a great accession of fresh knowledge.

As remarked by Dr. Guthrie in his Foreword to the book under review, voice and speech are of supreme importance to mankind. It follows that a treatise in which available knowledge regarding the mechanism of the human voice is examined and summarised must be of interest and value to many readers. Amongst those who are professionally interested in some aspect or other of the subject may be mentioned physicists, physiologists, medical specialists, phoneticians, teachers, public speakers, singers, telephone and radio engineers. Even the lay reader may feel interested in such questions as the following:—What is it that distinguishes the voices of different individuals from each other? What is the cause of the difference between male and female and between child and adult voices? What are the causes of stuttering and stammering? Is it possible to improve one's voice for speaking or singing by systematic training? What are the voice characters of an exceptionally fine singer? Why do some languages sound differently from others? Can the human voice be artificially imitated? The reader of Dr. Curry's book will find such questions discussed in it.

A perusal of the book shows that it is the product of both extensive and intensive study of the subject in its varied aspects. It covers a wide range of topics in a relatively small compass without being superficial or obscure. The numerous references given in the text and listed at the end will enable the reader who desires further knowledge on special topics to turn to the original literature. The book is well-produced and moderately priced. It may be heartily recommended.

C. V. RAMAN.

The Analytical Chemistry of Industrial Poisons, Hazards and Solvents. By Morris B. Jacobs, PH.D. (Inter-Science Publishers, Inc., New York), 1941. Pp. xviii + 661, 110 illustrations. Price $7.

This is the first of a series of monographs on analytical chemistry and its applications to be published by Inter-Science Publishers, Inc., and all concerned are to be congratulated on a notable addition to chemical literature.

The book is divided into nineteen sections with suitable sub-classifications, an appendix of valuable tables, and author and subject indexes.

Before proceeding to describe the chemistry, properties and determination of a comprehensive list of individual elements and compounds, five preliminary chapters are devoted to an illuminating discussion of industrial hygiene and industrial poisons. These comprise a descriptive chapter on drawing representative samples, the measurement of gas volumes and quantities, the apparatus and chemicals used for absorption and adsorption and their relative efficiencies and a description of the various methods of estimating dust microscopically and by chemical methods. The information in these general chapters is supplemented wherever necessary by more specific instructions throughout the text.

Wherever calculations or physical instruments of any other than stereotyped classes are described, the mathematics is adequately discussed and the apparatus illustrated by clear annotated diagrams.

In the following chapters are detailed the properties and general features of a very complete range of elements and compounds important in industrial hygiene and toxicology or used in chemical warfare. Methods of detection and determination adequately dealt with in the text are followed in all cases by valuable information on "physiological response", a notable and welcome feature of the work.

This volume is far too detailed to be classed as a text-book. It is a work of reference which should find a place in the equipment of the chemsits and works managers of all factories carrying out hazardous industrial occupations and in the libraries of universities, medical men and those working in the field of public and factory hygiene.

The paper, printing and diagrams are excellent and the bibliography is comprehensive and up to date. Printer's errors are few and far between but a rather more comprehensive subject index would have been an improvement as the present one does not contain many of the trade names or symbols of important compounds or preparations mentioned in the text. In cases of multiple references, it would also be an advantage if the page on which the principal and most detailed information is to be found were printed, as is common practice, in bolder type.

This minor criticism can easily be dealt with in a reprint or new edition which should soon be necessary to meet a demand stimulated by merit at a time when scientific method and control are being increasingly standardised in industry and social services.

H. B. DUNNICLIFF.

Experimental Physical Chemistry. By W. G. Palmer, D.Sc. (The University Press, Cambridge), 1941. Pp. xi + 321. Price 12*sh.* 6*d.*

This book by Dr. Palmer is obviously the outcome of a considerable amount of practical experience and demonstrates how many of the important principles of physical chemistry can be approached through the laboratory with the help of quite ordinary equipment. There is always a fascination in these home-made apparatus, particularly when they combine simplicity with reasonable accuracy. The book covers most of the syllabus for an Honours degree, and some of the exercises are indeed appropriate for more advanced students. Experiments which require special equipment such as Bomb Calorimeter, Refractometer and Spctroscope, are left over for reference to larger books. The chapters on Ionisation and Dilution will be found to be extremely useful to students and teachers in Universities and Colleges. A new and interesting feature is a chapter of exercises on crystallisation and properties of crystals. Lucid theoretical notes introduce each chapter and completely worked examples based upon data obtained with the apparatus as actually described elucidate in a most direct way the difficulties, demonstrate the possible accuracies, and assist in an orderly and significant exposition of data.

This book is to be highly commended to all Universities and Colleges.

M. A. G. RAU.

Analytical Processes—A Physico-Chemical Interpretation. By T. B. Smith. (Edward Arnold Co., London), 1940. Pp. viii + 470. Price 18*s.*

To incorporate, in the second edition of this useful book, the recent developments in the theory and the practical aspects of the subject, the author has effected considerable revision of the text. Matter adequately dealt with in standard text-books on physical chemistry has now been omitted and this has rendered it possible, with only a moderate increase in size, to have a discussion at length, of certain important aspects of analytical chemistry.

Notable topics considered in the book are: activity coefficients, modern conception of acids and bases, pH changes during acid-alkali titrations, hydrolysis, adsorption, adsorption indicators, oxidation and reduction processes. The chapters dealing with typical precipitations such as the sulphates of barium and lead, ferric hydroxide, the insoluble halides of silver, the separation of calcium from magnesium, are full of interest.

The book lays due emphasis on the theoretical principles of quantitative analysis. Without an adequate background of mathematics, however, the honours student in

chemistry will find it difficult to understand the mathematical treatment of physical chemistry in certain parts of the book.

The book is to be highly recommended as a reference work for honours students and as a supplement to ordinary text-books for those taking an advanced course in analytical chemistry. B. S. RAO.

Report on the Zoological Survey of India for the years 1938-41. (Manager of Government of India Publications, Delhi), 1942. Pp. 83. Price Rs. 2-6-0 or 4*sh.*

In the latest Report of the Zoological Survey of India, the Director has reviewed the various activities of the Survey—both in the field and in the laboratory—during the period 1938-41. The studies connected with the influence of the injurious organisms on the efficient working of the beds at Pulta Water Works, were continued during the period. The working of the Pulta beds has already materially improved after giving effect to the suggestions made by the Survey. Important investigations have been carried out on the migration of *Hilsa* fish. Several students from different parts of India were given facilities to conduct investigations and to learn the modern technique in zoological research. That most of these students have worked on fish and fisheries is a sign of the growing interest in ichthyology in India.

Among the outstanding contributions of the Department for the period are, Dr. Hora's work on the habits, life-history, etc., of *Hilsa*, the series of papers in which Dr. Hora has discussed the geographical relations of the Satpura Trend of mountains; Dr. Prasad's work on Pelecepods of India; Dr. Chopra's work on Crabs and Prawns from Karachi and other areas; Dr. Rao's work on Andaman Shell Fisheries and his consolidated report on it and Dr. Hafiz's papers on Hemiptera. During the period under report, large collections of both invertebrate and vertebrate animals have been added to the reserve material of the Department. Several papers have been published on this material by the leading specialists. The Departmental publications, namely, *Records* and *Memoirs of the Indian Museum*, have continued to maintain a high reputation as the leading journals for the publication of zoological work in India.

The funds sanctioned by the Government of India for the maintenance of the Zoological Galleries of the Indian Museum are very insufficient. If the valuable material collected by the Department has to be exhibited properly for the benefit of the public, the Government ought to provide adequate funds for the purchase of properly designed show-cases and for other expenditure connected with the preparation and display of specimens.

It must be emphatically pointed out that the existing staff of the Zoological Survey of India and the funds provided for its working, both in the field of survey and research over a vast continent like India and the management of the Zoological Gallaries of the Museum, is very inadequate. The Director has rightly pointed out that the staff and the annual grants have to be materially increased if the Department has to work efficiently. B. S. B.

Report of the Education Department, London, 1939-40. (Office of the High Commissioner for India), 1941. Pp. 32. Price 3*s.* 8*d.*

This is a Report of thirty-two foolscap pages and it costs Rs. 2-12-0—perhaps the costliest Report ever published. It is commonly supposed that Government Reports are priced low in order that more people may buy them; but in this case it would appear that the opposite principle applies, namely, that more people should *not* buy them. Moreover, the title of the Report is most misleading. That the Report has any reference to India can only be discovered from the information, given inconspicuously in small type on the front page, stating that it emanated from the Office of the High Commissioner for India.

The Report deals with the arrangements that had been made, during the year 1939-40, for the education of Indian students in the various British centres of learning. The war had already caused considerable dislocation in these arrangements, but in spite of it all more than a thousand Indian students of both sexes had managed to carry on their studies, sometimes with great distinction. It is pleasing also to note that in these difficult circumstances Indian students not only showed commendable calmness and courage but many actually rendered valuable services in the prosecution of the war.

D. S. GORDON.

IRRIGATION RESEARCH IN INDIA

THE *Annual Report of the Central Board of Irrigation in India* (Publication No. 24, 1942, pp. ii + 260), is a record of the technical work of the Central Board of Irrigation during the year 1939-40. The technical discussions embodied in the Report are the result of two meetings of the Research Committee and the Eleventh Annual Meeting of the Central Board of Irrigation held during 1940. The contents of the volume are divided into twenty-one groups to facilitate reference and the discussions at the meetings appear classified under the different groups.

The Central Irrigation and Hydrodynamic Research Station, Poona, carried out during the year 1939-40, among other things, a number of experiments on silt control and scour in canals, river training, profile for high coefficient weir, canal falls of various designs, flow in expansions in open channels and scale effect of models. Theory, design and construction of Gibb modules, Ganges flood and its lessons and relationship between meander belts and width and discharge of rivers on flood plains and of incised rivers are some of the papers published by the Station.

The Punjab Irrigation Research Institute continued to carry out its investigations on river models of the Sutlej River downstream of Panjnad Headworks, the Chenab River upstream of Khanki Headworks, the River Ravi upstream of Madhopur Headworks, the Beas River upstream of Islam Headworks. The Chemical Section continued its work on the effect of the soil crust on the rise of water-table and its studies on the stabilisation of soil. The transmission constants of water-bearing sands, the influence of shrouding, the diameter of the strainer and the influence of its position with respect to impermeable strata on the discharge and the determination of permissible velocity of flow through sand continued to engage the attention of the Physics Section. In the Land Reclamation Section, studies of the movement of moisture and salts in the soil were continued, both in the field and in the laboratory.

The Poona Irrigation and Research division was engaged during the year on problems connected with economy of water, land drainage and reclamation, and the adoption of effluent irrigation. The Development and Research Division, Sind, carried out a number of experiments on models of irrigation works, conducted a variety of experiments on the field, to determine the value of coefficient 'C' in the broad-crested weir formula, absorption and evaporation losses in water courses passing through typical soils in Sind, and requirements of water for various irrigation units, and conducted silt survey of channels and made investigations in connection with Lacey's silt theory and the statistical relation between the mean velocity of a section and the central surface velocity and such other relations. The United Provinces' P.W.D. (Irrigation) Research Section studied the efficiency of linings and the technique of sodium carbonate lining, conducted a number of experiments on models of irrigation works and carried out investigations on canal and gul losses.

Discussions at the meetings are, as already stated, classified into different groups. Among the subjects discussed are the following: Design of Channels in alluvium, Silting of Reservoirs, Flow in Rivers and Canals, Opinions on Kutter's and Manning's formulæ and Lacey's regime formula, statistical data pertaining to River Flood Control and Meandering of Rivers. Enumeration of some of the subjects discussed has been done to indicate the very valuable work carried out by the five Irrigation Research Stations in India. The Annual Report (Technical) of the Central Board of Irrigation is a volume containing much useful and instructive information on a variety of subjects of special interest to irrigation engineers.

C. GOPALAKRISHNAN.

PILOT PLANTS AS A BASIS FOR THE DESIGN OF LARGE-SCALE EQUIPMENT*

BY

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WHETHER it is a new chemical process, or a fresh venture into the production of an already established product, the design of a full-scale plant for a given output must be based on trial experiments on a semi-works scale. But a correlation between the pilot plant and the full-scale works is not a simple exercise in arithmetic; it involves a careful and rational interpretation of the various attendant physical and chemical factors. Failure to recognise this has led to frequent disappointments, and financial failures on account of the unexpectedly poor performances of large-scale plants after erection. On the other hand, there are cases where very favourable results have been obtained with a large-scale plant, although the pilot-scale experiments were discouraging and difficult. A classical example of this is provided in the initial experiments of C. M. Hall on the manufacture of Aluminium. It is rather poignant that such an element of risk should be incident just where the biggest outlay in capital is involved.

A systematic study of the vast experiences gained in this field and a thorough understanding of the fundamental principles involved have led to the modern science of chemical engineering design. It is now possible with the help of these theoretical methods and a set of basic experimental data to design various types of industrial equipment of any desired capacity and performance, as for example, evaporators, fractionating columns, settling tanks, heat exchangers, absorption towers, driers, etc. All these achievements are, however, mostly confined to processes which involve in the main physical operations only. They also largely run parallel with corresponding developments in other branches of engineering. In all cases, the required 'model' experiments for acquiring basic data for design are planned on the principle of similarity. According to this principle, one determines a single or more dimensionless parameters which are characteristic for the operation under consideration. The functional relationships involving these dimensionless numbers are then determined through the model-scale experiments. Now, whatever be the size of the plant, for conditions which result in the same value for the dimensionless parameters, the function of the plant is identical, and can be correlated in a linear scale ratio. Thus, for all cases of fluid flow, correlative results are obtained at equal Reynold's numbers $\frac{DU\rho}{\mu}$, where D is a linear dimension which determines the flow such as diameter for a pipe with circular cross-section, U is the linear rate of flow, ρ the density and μ the viscosity of the fluid. Wide use is made of this principle, for example, in aerodynamic studies on model planes suspended in wind tunnels. Here with the help of the scale models and highly compressed air the value of $D\rho$ in the Reynold's expression is kept constant and the results obtained with the models then translated for the full-scale prototypes at the prevailing atmospheric pressures. Similarly hydrodynamic experiments are performed with ship models in water tanks in order to obtain the necessary data for the final shipping designs. Such conditions of dynamic similarity are also successfully employed for the design of heat transfer equipment in chemical plants. Here the dimensionless expressions required have to include additional temperature factors, and a few of those commonly used in design practice are:

the Prandtl number $\frac{C\mu}{K}$ for evaluating temperature drop across films,

the Peclet number $\frac{DU\rho C}{K}$ for heat transfer in viscous oils in laminar flow, and

the Grashof number $\frac{D^3\rho^2 g\beta\Delta t}{\mu^2}$ for heat transfer under conditions of natural convection.

Here C is specific heat, K the thermal conductivity of fluid, β the volumetric

* Contributed to a Symposium on "Fabrication of Scientific and Industrial Equipment," held at Bangalore, April 1942.

coefficient of thermal expansion, and the other symbols have the usual significance.

When a unit operation includes a chemical reaction also additional factors such as energy of activation, reaction velocity, etc. must be taken into consideration for deriving the appropriate dimensionless numbers for pilot plant studies. The problem thus becomes more complex but all the same it will be useful to determine one or more such criterions for similarity so as to enable one to predict with reasonable certainty the effect of a change of scale.

$$\text{I.}\quad \frac{\text{Number of molecules chemically changed}}{\text{Number of molecules supplied by turbulent currents}} = \frac{\nu_j U l}{C_j v}.$$

$$\text{II.}\quad \frac{\text{Number of molecules chemically changed}}{\text{Number of molecules supplied by diffusion}} = \frac{\nu_j U l^2}{C_j D_j}.$$

$$\text{III.}\quad \frac{\text{Chemical heat developed}}{\text{Heat removed by convection}} = \frac{QUl}{C_p \rho \theta v}.$$

$$\text{IV.}\quad \frac{\text{Chemical heat developed}}{\text{Heat removed by conduction}} = \frac{QUl^2}{\lambda \theta}.$$

Few systems are governed by a criterion of purely chemical similarity with respect to concentration, reaction rate, etc. Several physical factors are inevitably associated with the systems in which chemical reactions take place. Thus, materials must be transported to and from the reaction centres by diffusion or turbulent currents. Frequently considerable heats of reaction have to be suitably transferred to the surroundings from the interior in order that a system may be maintained at a desired reaction temperature. The conditions of dynamic similarity dictated by such physical factors are in general not compatible with corresponding conditions required for purely chemical similarity. For example fluid velocities required to give equal Reynold's number would not allow of equal reaction times in the large- and small-scale apparatus. A complete mathematical solution of this problem is beset with difficulties. However a solution can be approached by first considering systems under conditions in which one of the factors alone is predominant. Thus, for a process in which the chemical reaction velocity is sufficiently low to be determinative, factors of chemical 'resistance' are the most significant, and the "physical resistance" factors can be ignored. Hence for drawing up correlations, conditions of dynamic similarity will play a very much less prominent role compared to conditions of chemical similarity. On the other hand, if the physical resistance is much the greater of the two, then conditions for chemical similarity can be ignored and scale relations can be drawn for conditions of dynamic similarity only, as for example, the maintenance of the same degree of turbulent motion in both systems.

The first attempt on problems of this nature was made by Prof. Damkohler of Gottingen in 1936 (*Z. Elektrochem.*, 42, 846). Proceeding from fundamental equations expressing conservation of mass, heat, and momentum, he derived the following four characteristic dimensionless factors:

Where ν_j is the stoichiometric coefficient of substance j, for the chemical equation $\nu_1 A_1 + \nu_2 A_2 + \cdots \rightarrow \nu_3 A_3 + \nu_4 A_4 + \cdots\cdots$

U is the true chemical reaction velocity $\frac{\text{Moles}}{\text{Cm.}^3\ \text{Sec.}}$

l = linear dimension of system.

C_j = molar concentration of substance j.

D_j = Diffusion coefficient of j, $\frac{\text{Cm.}^2}{\text{Sec.}}$

Q = Heat of reaction per mole, $\frac{\text{Cal.}}{\text{Mol.}}$

C_p = Specific heat of reaction mixture at constant pressure.

ρ = density of reaction mixture.

v = flow velocity of reaction mixture.

θ = temperature above an arbitrary zero.

K = Thermal conductivity of reaction mixture.

If any of these numbers be identical in the two systems, large and small, then a chemical process must be proceeding identically in both but with different total performances. Damkohler has considered the simplified case of a cylindrical reaction vessel, and derived from the groups I, III and IV, relative dimensions for the small- and large-scale sizes with a ratio of output n. The chemical process assumed is a continuous one, with a turbulent flow through the system, the rate of chemical reaction being the controlling factor.

		Small	Large
I. Homogeneous reaction—			
Length in direction of flow		L	$Ln^{\frac{2-m}{2+m}}$
Diameter		D	$Dn^{\frac{m}{2+m}}$
Fluid velocity		v	$vn^{\frac{2-m}{2+m}}$
II. Heterogeneous reaction—			
Length in direction of flow		L	$Ln^{\frac{2}{2+2m}}$
Diameter		D	$Dn^{\frac{m}{2+2m}}$
Fluid velocity		v	$vn^{\frac{2}{2+2m}}$

It is found that $m \sim 0{\cdot}8$, for turbulent flow, and $m \sim 0$, for laminar flow. Thus when $n = 10$, that is for a tenfold increase in production, the cylindrical reaction vessel must be 3·3 times longer and its diameter only 1·7 times more. The reaction vessel is thus geometrically distorted.

R. Edgeworth-Johnstone has more recently taken the subject up a little further [*Trans. Inst. Chem. Eng.* (England), 1939, p. 129] by introducing simpler dimensionless factors derived from the rate of reaction formula and the Arrhenius equation relating to reaction velocity with temperature. For homogeneous chemical reactions of any order n, two dimensionless factors can be used

$(\chi_n \cdot a_2 \cdot\cdot a_3 \cdots a_n \cdot t)$ and E/RT, where χ_n is the constant in the Arrhenius equation $K_n = \chi_n \cdot e^{E/RT}$, a_n is the stoichiometric concentration, and the other symbols have the usual significance. For heterogeneous chemical reactions, the extent of interfacial areas must also be taken into consideration. On the basis of the above similarity principles Edgeworth-Johnstone has shown that if two reaction vessels have volumes V and n^3.V, *i.e.*, are related by scale factor n, then for a chemical reaction taking place at the same temperature and with the same initial concentrations, the volume rates of flow should be Qn^3 for the homogeneous reaction, Qn^2 for a heterogeneous system filled with geometrically similar catalyst grains, but Qn^3 for a heterogeneous system filled with catalyst grains of identical size in both systems.

The theoretical considerations outlined above regarding the application of similarity theory in chemical plant design constitute an important development of considerable significance in Chemical Engineering. Their practical utility is at present somewhat limited, but to a large extent they serve to visualise and to understand the nature of the difficulties in the designing of large-scale equipments on the basis of pilot plant work.

CENTENARIES

Lukin, Lionel (1742–1834)

LIONEL LUKIN, British inventor of lifeboats, was born at Dumow 18 May, 1742. He became a member of the Coachmakers' Company in 1767 and continued in that business till 1824. He was a personal favourite of George IV and of Windham, the Secretary of State for War. He was also full of fertile mechanical gifts.

The first life-boat was conceived by Lukin in 1785. His pamphlet on this invention was published in 1790. Despite the patronage of the king, public apathy in regard to shipwreck stood in the way of Lukin getting his due recognition during his life-time.

Lukin secured buoyancy by means of a projecting gunevale of cork and air-chambers inside. He secured stability by a false iron keel. Lukin also invented a raft for rescuing persons from under ice, a rain gauge and an adjustable reclining bed for patients.

Lukin died at Hythe, Kent, in his ninety-first year, 13 February, 1834.

Seaward, Samuel (1800–1842)

SAMUEL SEAWARD, a British Engineer, was, with his brother John, the joint-owner of the Canal Iron Works which specialised in marine engines. The brothers supplied machinery to all parts of the world. They were pioneers in the construction of engines which provided speed without loss of comfort. The double-slide valve both for the steam and the exhaust, which they invented, resulted in a great saving in the consumption of fuel. This led to the adoption of their engines by the vessels of the East India Company and of several navigation agencies. They also advocated the use of auxiliary steam power for the voyage to India.

Samuel Seward died in London 11 May, 1842.

Lofting, John (1659-1742)

JOHN LOFTING, a Dutch inventor, was born in 1659. He set up practice in London in 1688 as a merchant and manufacturer of fire-

engines. Before coming to London he spent seven years at Amsterdam with one of the masters of fire-engines. He applied his engines to some of the royal palaces, and private houses. But as he was not properly compensated, he was obliged to discontinue his efforts.

By the end of 1690 Lofting seems to have been engaged in the manufacture of fire-engines on a considerable scale. For in November of that year, he presented a petition to the king saying that "iron-ware being absolutely necessary for the making of your petitioner's engines for extinguishing of fire, and your petitioner being a Dutchman borne and ignorant of the laws of this nation, did import from Holland lately a small parcel of wire". This valued at £67-18-0 had been seized by the officers of the customs. This petition brought him the desired relief.

Lofting became bankrupt in 1700 and settled at Great Marlow. He died 16 June, 1742.

S. R. RANGANATHAN.

Madras University Library,
Coimbatore,
June 4, 1942.

SCIENCE NOTES AND NEWS

Depolarisation of Light Scattered by Sols.—Hoover, Putnam and Witenberg (*J. Phys. Chem.*, 1942, **46**, 81) have reported careful measurements of the depolarisation factors of the light scattered by monodispersions of bentonite and ferric oxide. The reciprocity theorem of Krishnan is found to hold accurately. The measurements can be taken advantage of for a rapid estimation of particle size of bentonite. The depolarisation values are found to be independent of concentration, if the concentration of the colloid is less than 0·1 per cent. K. S. G. D.

Viscometry.—Mr. T. Tirunarayanachar has described, in the *Indian Journal of Physics*, 1941, **15**, 418) a convenient and improved type of the logarithmic decrement method for comparing the viscosities of highly viscous liquids. The vibration curves of a suitably mounted oscillating sphere are recorded by a simple photographic device, and from the measurements on the records, the damping coefficients can be estimated and compared. The method is demonstrated to be convenient and quick.

Anthelmintic Action of Phenothiazine.—Lapage (*Ind. J. Vet. Sci. & Animal Husbandry*, 1941, 11) has described in detail his experiments to assess the value of phenothiazine for the destruction of nematodes in sheep, goat, horse and pigs and the effect of the drug on the hosts. Given at the rate of 0·1 gm. per lb. of body weight to lambs and ewes, there was considerable fall in the egg count and by a comparative study it was elicited that this drug is far superior to either copper sulphate alone or copper sulphate and nicotine combined both in its anthelmintic and weight-increasing effects. Similar effect was observed in a goat which received a dose of 0·15 gm. of phenothiazine per lb. of body weight and in a horse which was given 0·1 gm. of phenothiazine powder per lb. of body weight.
S. D. A.

***Babesia foliata* n. sp. from a Sheep.**—A new species of *Babesia* found in the erythrocytes of sheep in Mukteswar-Kumaun, U.P., India, and named *Babesia foliata* n. sp. on account of its flattened and leaf-like outline, has been described (Ray and Raghavachari, *Ind. J. Vet. Sci. & Animal Husbandry*, 1941, 11). This species differs from the other two met in India, *viz.*, *Babesia sergenti* encountered in the Imperial Veterinary Research Institute, Mukteswar (1932) and *Babesia motasi* in Mysore by Achar and Srikantiah (1934). Transmission experiments on sheep and goats showed that the disease was transmissible to sheep by intravenous injection of fresh infected blood but not to goats. The ticks involved are not mentioned in this article. S. D. A.

Utilisation of Virginia Tobacco Seed.—Unlike the local varieties of tobacco in India which are all "topped" after some 12 to 16 leaves have developed and in that way prevented from flowering and setting seed Virginia tobacco is allowed to grow, flower and set seed, the reason being that a thin mild leaf is desired in the latter while in the former heavy and somewhat coarse and rank leaves are desired and the sap is all therefore directed into the leaves without any of it having to be used for flowers and seeds. There is at present some 1,25,000 acres of Virginia tobacco grown in the Guntur and adjoining districts of Madras, all of which is allowed to seed. As the seed required for sowing purposes is exceedingly small the quantity of surplus seed that is available is very large, estimated, in fact, at 8,000 tons per annum. Can these seeds be turned to any profitable use? The answer is furnished in certain studies by Swami Rao and Narasimham (*Ind. Jour. Agr. Sc.*, 12, Part II). These Virginia tobacco seeds are found to contain from 35 to 37 per cent. of an edible oil which is also a semi-drying oil. It therefore compares with ordinary gingelly oil as an edible oil and with linseed oil as a drying oil, although its drying properties are only partial unlike linseed oil. As against this drawback it is found that tobacco seed oil is quite colourless and does not develop a yellow tint in course of time in the white paints with which it may be mixed in the way that linseed oil does; so that, in these two respects it may be considered superior. The oilcake contains about 5½ per cent. of nitrogen and is a valuable cattle feed and can also be used as a manure. Neither cake nor oil has any nicotine in it and feeding trials with the cake as compared with groundnut oil

cake showed that they were similar and one could be substituted for the other. We are also told that viands made with tobacco seed oil were found quite as good as those made with gingelly oil. The material is thus made out to be a valuable product. We would, however, suggest considerably more by way of feeding trials of both cake and oil before they are attempted to be popularised for these purposes. As regards the oil for use in paints and varnishes, the Government of Madras has sanctioned a grant for further investigation.

A. K. Y.

Manufacture of Pine Wool.—The large pine forests of the Himalayas provide plenty of dry pine leaves, which, as they are hard and pointed, are known as pine needles. By collecting them, digesting with 1 per cent. caustic and further processing, a soft fibrous and sufficiently resilient material, known as 'pine wool' can be made. This is a very good packing material for fruits both soft and hard, and can in addition be used for stuffing mattresses and other upholsters, when the slight smell of pine oil which persists helps to provide hygienic properties also. Dr. H. N. Batham has carried out an extended series of experiments on the manufacture of pine wool and its cost, and published his results as Bulletin No. 30 of Department of Industries and Commerce, United Provinces.

Algal Parasites and Plant Diseases.—Many species of *Cephaleuros* are found to cause great loss to economic plants in India. *Cephaleuros mycoidea* Karst. causes the red rust of tea in Assam and Chittagong and other tea-growing areas. The alga is epiphyllous, developing in small discoid patches. The red colour of the filaments is due to the hæmatochrom which masks the green colour of the chloroplast. The damage caused to the tea leaves is very insignificant, but the twigs of the host which are parasitised by the alga, show stunted growth and etiolation, and gradually dry up. Extensive defoliation of the twigs is also of common occurrence. Mango plants are also found some times parasitised by *Cephaleuros mycoidea*, the infection causing the defoliation of twigs and other malformations.

In Florida, U.S.A., *Cephaleuros virescens* Kunze. (*C. mycoidea*) severely infects the leaves and fruits of Gauva plant. The twig and bark infections are of little consequence. The fruit blemishes are often said to be accompanied by cracking of immature fruits (Ruehle, *Phytopathology*, 31, 95). Distant plantings of the trees and application of fungicides like sulphur and Bordeaux mixture are the only means of controlling the parasite. M. J. T.

Agricultural Products as Insecticides.—About 100 million dollars' worth of insecticides and fungicides are employed annually against insect pests and fungous diseases causing an annual loss of three billion dollars in the United States of America. Although the materials, now largely used for this purpose (compounds of arsenic, fluorine, lead, copper and sulphur), are of mineral origin, vegetable products are also being used, to an increasing extent. This is because, many organic compounds are more toxic to insects, but less so to man, than are arsenates, and other inorganic compounds (poisons). In addition to organic insecticides that exist naturally in plants such as nicotine, anabasine, the pyrethrins, rotetone, groundnut oil and other plant oils, products derived from coniferous trees, such as Pine-tar oil, are also valuable insecticides; and synthetic compounds derived from oils, alcohols, furfural and other promising plant products, are now coming into commercial use as insecticides. It is conjectured that in the future, insecticides will be mostly organic compounds, obtained from plants now regarded as worthless weeds, or synthesised from products of plant origin. The possibilities of constructive chemical research in this field are boundless, and should result in numerous products of great economic value. (Roark, *Industr. Eng. Chem.*, 1939, 31).

Paper from Grass.—Investigations carried out at the Forest Research Institute on the possibility of utilising *ulla* grass (*Themeda arundinacea*), until recently known under the name of *Anthisteria gigantes*, for the manufacture of wrapping and packing papers are described in Forest Bulletin No. 100.

This grass is available in the forests of the United Provinces in sufficient quantity and at economic prices to support a mill with a capacity of about 6,000 tons per annum.

Petty shopkeepers, as well as big merchant firms, are making increasing use of imitation kraft paper (the average annual imports of which during the year 1935-36 to 1939-40 were about 10,000 tons) in place of old newspapers and brown wrappings, as the consumer nowadays "regards the use of kraft papers as decidedly cleaner, more hygienic and more acceptable to his æsthetic sense", says the Bulletin.

Investigation has shown that wrapping and packing papers produced from *ulla* grass are superior in quality to old newspapers and brown wrappings, while they are estimated to be cheaper than imported imitation kraft papers.

The Bulletin further points out that the total capital requirements for the manufacture of 6,000 tons of wrapping papers per annum is estimated (at pre-war price levels) to be approximately Rs. 31,00,000, and the yield on a capital investment of Rs. 27,00,000 about 8 per cent.

Manufacture of Dried Fruits from N.W.F.P.—A Press Note, dated 30th May 1942, issued by the Supplies Department, Government of India, states that a scheme for the scientific processing of dried fruits on a large scale has been introduced by the N.W.F.P. Government.

The plant, which is expected to turn out 4,000 tons of dried fruits per year, will include several up-to-date forced draft tunnel dehydrators and sulphur houses and a processing and packing plant, besides accommodation and equipment for receiving, preparing and storing the fruits.

The North-West Frontier Province and, to a lesser extent, Baluchistan are the main sup-

pliers of dried fruits required by the Defence Services. In both cases, however, the supplies are largely derived from Afghanistan *via* tribal territory. Hitherto, the fruits have been mostly sun-dried under indigenous conditions, with the result that rejection on account of dirt and insect infection have been considerable. During recent months, some processing has been undertaken by the N.W.F.P. Government on an existing plant, but the output has been limited owing to insufficient capacity. The present scheme, it is expected, will soon ensure an adequate supply of dried fruits, hygienically processed and packed.

Baluchistan Sulphur.—According to a Press Note, dated 6th May 1942, issued by the Department of Supply, Government of India, "deposits of crude sulphur discovered in Baluchistan are now being worked out by Government.

"In view of the extreme difficulty now being experienced in obtaining sulphur from America and of the high prices charged, it is felt that consumers would be well advised to investigate the possibility of using crude Baluchistan sulphur.

"An organization for the sale and distribution of the ore is being set up under the supervision of the Directorate-General of Supply, Chemicals Directorate, New Delhi, to whom all enquiries and applications for the ore are to be made."

Every endeavour will be made to supply ore containing not less than 50 per cent. of sulphur. The impurities which occur with the sulphur are not of a harmful nature and consist mainly silicious materials and calcium sulphate. Free sulphuric acid occurs to the extent of about one per cent. Arsenic is present in traces, generally determined as less than five parts per million. The crude sulphur is free from selenium and bituminous matter.

It is considered that this sulphur can be utilized in sulphuric acid plants using the chamber process and also in sugar refineries provided certain modifications are carried out to existing burners. Difficulties may arise over the high proportion of impurities present, but such difficulties are likely to be of a comparatively minor character.

For certain purposes, it is recognised that refined sulphur is essential and the Department of Supply is pursuing the question of erecting a refinery as soon as possible, but some months must necessarily elapse before the completion of such a plant.

Jute Yarn Tests.—During the last three years, among other important investigations undertaken, the Technological Research Laboratories of the Indian Central Jute Committee have carried out tests on a large number of samples of yarn representing the various qualities produced in the Calcutta mill area. Technological Research Memoir No. 4, just issued by the Indian Central Jute Committee, embodies the results obtained and gives full data for hessian warp, hessian weft, sacking warp, sacking weft and other qualities. "The results show the range in quality met with in each type of yarn as produced by different mills and give useful individual and mean values for the various characters examined, including grist, tensile strength, extension at break, ballistic work of rupture, twist and regularity.

"The data are used as the basis of a provisional scheme, set forth in the Memoir, for classifying the various types of yarn according to quality. This classification is based on strength and regularity.

"Although other characters, such as colour and degree of speckiness, are of importance in deciding the purposes for which a yarn is suitable it is considered that the two characters used in the main classification should be regarded as of prime importance in the scientific grading of yarns. A routine method for determining degree of speckiness is in operation in the Laboratories."

Causes of Maternal Mortality in the City of Bombay.—Investigations into the causes of maternal mortality, initiated by the pioneer work of A. Lakshmanaswami Mudaliar in Madras (1933), are of the greatest importance in any attempt to cope with one of the most acute health problems in India. Dr. (Miss) Jhirad has analysed and reported on the maternal mortality in Bombay from July 1937 to June 1938 (*Health Bull.* 29. Manager of Publications, Delhi, 1941. Pp. iv + 98. Price Rs. 1-8-0 or 2*sh.* 3*d.*). Among 38,243 births, 525 fatal issues occurred, giving a total mortality rate of 13·5 per 1,000 births. Excluding associated diseases, 340 fatal cases or 66·1 per cent. were directly connected with childbearing which reduces the mortality to 8·33 per thousand. Puerperal sepsis was responsible for 39·1 per cent., anæmia for 17 per cent. of mortality, eclampsia and puerperal hæmorrhage follow with 11 and 9 per cent. respectively. Seventy-seven per cent. of the fatal cases showed an "avoidable factor" (Dept. Committee on Maternal Mortality and Morbidity) in their history. Of the total deaths due to sepsis 43·6 per cent. occurred in deliveries by untrained women (*dais*). Seventy-one per cent. of deaths were registered among the poorest population, living in one-room tenaments in congested areas. The surprising fact that only 28·8 per cent. of the maternal deaths are to be found among home deliveries, which is in accord with the fact that 75·7 per cent. of all the births took place in institutions, is explained by the authoress's statement that a fairly large number of small maternity homes under general practitioners and midwives are not any better than third class hotels and need drastic reform in the matter of over-crowding, sanitation and methods of work. Equally as important as the facts and figures, presented in a lucid and convincing way, are Dr. Jhirad's recommendations for reducing the maternal mortality to the level of the West, *viz.*, 3·8 per 1,000 live-births in England and Wales (1936). The highly dangerous untrained *dai* has to be eliminated and replaced by midwives, trained on the lines of a Midwives' Act, which should be brought into force without delay. "Flying squads", who could bring help to the patient's home, would popularise home deliveries, necessary to avoid over-crowding of hospitals. The training of the medical

practitioner needs substantial improvement; regular post-graduate and refresher courses are necessary to keep up his standard. Further development of ante-natal centres with a sufficient number of beds is essential and the public has to be taught by social service organisations, health visitors and municipal midwives to make early and regular use of them; among the investigated cases only 21·2 per cent. had adequate ante-natal care. Finally the housing conditions, the prices of essential foodstuffs, especially those containing the highest amount of vitamins, and their relation to the wages should attract the serious attention of the authorities. The investigation under review contains a wealth of valuable material, which should be studied by everybody concerned with the welfare of the community. ROBERT HEILIG.

The Tuberculosis Association of India.—The most important events during the year 1941 (*Annual Report*, Tuberculosis Association of India, New Delhi, 1941, pp. vi + 121) were the opening of the Lady Linlithgow Tuberculosis Sanatorium in Kasauli and the development of the New Delhi Tuberculosis Clinic. The sanatorium in Kasauli contains at present 120 general ward beds and 10 special wards, whereas the construction of 40 cottages is planned; further it affords training facilities for medical men who intend to specialize in tuberculosis (nine months' course). Opened in May 1941 and endowed with all the requisite diagnostic and therapeutic equipment, 29 patients were treated there for more than one month upto the end of the year.

The clinic in New Delhi is intended to serve as a diagnostic centre. The number of new cases which attended the clinic was 1,694. The patients are returned to referring institutions and doctors with diagnosis and advice and they are treated at the clinic only at the express wishes of the doctors concerned. The total number of patients who were seen at this institution since November 1940 was 20,375. Seventy-six cases were admitted to the eight clinical beds, meant for observation, treatment and minor operations. The clinic employs health visitors who investigate the patient's home conditions and bring "contacts" for examination to the centre; out of 869 "contacts", 10 per cent. were found to be suffering from tuberculosis. A simple and cheap outfit for the burning of sputum was devised and deserves wide distribution.

Reports on the working of the Medical Commissioner and the affiliated institutions in Provinces and States complete the picture of the Tuberculosis Association's manyfold activities.

It is the good fortune of India that every attempt to improve the still sad conditions of tuberculous patients finds the enthusiastic and powerful support of Her Excellency the Vicereine, the Founder-President of the Association. Her deep understanding of the specific local difficulties are expressed in the following words, which the medical profession should take to heart: "It is necessary to emphasize that the greatest difficulty in the tuberculosis campaign in India is not, as generally supposed, lack of money, but the lack of a sufficient number of doctors properly trained in modern methods of diagnosis and treatment. It is a hopeless task to try to fight tuberculosis in India without having doctors who have specialized not only in diagnosis and treatment but also in the prevention of the disease and in the care and after-care of the tuberculosis patient." ROBERT HEILIG.

Imperial Veterinary Research Institute.—According to the Annual Report of the Institute, just published, arrangements are being made to produce in India veterinary drugs which were previously imported. A considerable number of these drugs can be synthesised or extracted from indigenous plants. To develop this industry, experimental cultivation of medicinal plants on the plains and in the hills and tests on animals may soon be undertaken.

A new vaccine against Ranikhet disease, which is generally the cause of setbacks in attempts at large-scale poultry farming in India, has been produced at the Institute. Tests have proved that the new vaccine is capable of giving good and safe results.

Research on warble fly pest is now nearing completion. Data are available on the respective incidence of parasites in cattle and goats and the ecological conditions which are favourable for its development.

A comprehensive investigation has been started on the influence of climatic factors on animal disease in India. Among other problems under investigation are contagious pleuropneumonia, contagious abortion, acute theileriasis which is fatal to calves, diseases of goats and the utilisation of the so-called famine fodders.

The role of vitamins in animal nutrition has been studied. Chief interest is centred round vitamin "A" and its precursor, carotene, insufficiency of which is known to produce serious nutritional disorders common in India.

Indian Statistical Institute.—The Annual General Meeting of the Indian Statistical Institute was held on the 29th April 1942 at 4-30 p.m. in the Statistical Laboratory, Presidency College, Calcutta, with Sir A. H. Ghuznavi in the chair. The activities of the Institute during the year 1941-42 were reviewed in the Annual Report presented at the meeting. Among the various enquiries undertaken by the Institute during the year, mention may be made of the following:—Area Census of Jute, Bengal Labour Family Budget Enquiry, Crop-cutting Experiments and a Survey of Public Opinion and Listeners' Reaction to Broadcasting in India. The Hon'ble Mr. Nalini Ranjan Sarker, Member-in-charge of the Department of Education, Health and Lands, Government of India, was elected President for the year 1942-43. Prof. P. C. Mahalanobis was re-elected Hon. Secretary of the Institute and Prof. K. N. Chakravarti and Mr. K. R. Nair were elected Hon. Joint-Secretaries.

Fisheries Technological Institute, Tuticorin.—The opening of a Fisheries Technological Institute at Tuticorin had been engaging the attention of the Government since 1932. Early in 1932, the *Baratha Mahajana Sangam*, Tuticorin,

presented a Memorial to the Government, requesting the establishment of a school at Tuticorin, which will impart to the students of the fishermen community, improved methods of catching and preserving fish as well as impart them education in Navigation. This materialised in the establishment of the Institute at Tuticorin in 1942. The Institute provides for the training of teachers in Fishery Technology after their regular course in the Teachers' Training Schools. It also provides courses of instruction to the fishermen and the public in all branches of the fishing industry including Navigation.

The Institute has three courses of studies. The first course is training in Fisheries Science to the Trained Teachers. The course is for one year. The subjects taught under Fisheries Science are Biology, Fishery Technology, Socio-Economics and Navigation. The Trained Teachers are given training in Carpentry also. Usually, teachers possessing Higher Grade Elementary Training Certificate are admittcd. The second course is Navigation Course. Sons of fishermen are given training in sculling, signalling, stitching of sails, handling of ropes and sailing of small vessels. The Institute has a model Dummy Top sail schooner to acquaint the candidates with the riggings and shrouds of a square rigged sailing ship. The object of the training is to train the boys in duties pertaining to lower deck so that they may sit for the Board of Trade Examination after the requisite service in the sea. This course is for three years. The third course is a short course in Fishing industry for persons who intend to trade in fish such as Fish curing, Fish meal manufacture and Fish canning and other allied fishing industries.

The medium of instruction for all the three courses is Tamil.

The Board of Industries and Commerce in Mysore met on 23rd March 1942 under the Presidency of Rajasevaprasakta Mr. A. V. Ramanathan, B.A., Minister for Law.

The report of progress made in regard to pending subjects since the last Board Meeting held on 9th September 1941 was reviewed by the Board. The progress made on the several schemes was explained by the concerned officers.

The Board supported the recommendation of the Board of Industrial Planning and Coordination that a competent medical graduate be appointed for study of the incidence of the several occupational diseases among industrial employees in the State.

The manufacture of a suitable starch in place of sago flour, which is one of the main ingredients used in the sizing mixture in the textile trade and which is difficult to import now owing to the international situation, was considered and the matter was referred to the Director of Industries and Commerce for further investigation.

Soil Investigation in Sind.—An investigation scheme to determine the soil and sub-soil conditions in the Lloyd Barrage Zone has been approved by the Imperial Council of Agricultural Research.

Sixteen stations, scattered throughout Sind, have been established for the purpose and already over 3,000 soil samples have been examined in regard to their texture, salt content, base exchange capacity and other physico-chemical properties.

The scheme is for three years and a full report will be published after fully analysing the data.

Moos Gold Medal.—Professor Maneck B. Pithawalla, D.Sc., F.G.S., of Karachi, has been awarded the Moos Gold Medal by the University of Bombay for the best thesis on scientific research for the year 1940-41.

Lady Tata Memorial Trust.—The Trustees of the Lady Tata Memorial Trust announce the awards of the following Scholarships and Grants for the year 1942-43:

A. INTERNATIONAL AWARDS for research in diseases of the blood with special reference to Leucæmias:—(1) Dr. Jacob Furth, Cornell University Medical College, New York, (£400). (ii) Dr. P. A. Gorer, Guys Hospital, London, (£70). (iii) Dr. A. H. T. Robb-Smith, Oxford University, (£300). (iv) Dr. Werner Jacobson, Strangeways Research Laboratory, Cambridge, (£300). (v) Dr. Sybil Williams, Cambridge, (£350). (vi) Prof. Doljanski, Jerusalem (£400).

B. INDIAN SCHOLARSHIPS of Rs. 150 per month for one year from 1st July 1942 for scientific investigations having a bearing on the alleviation of human suffering:—(1) Mr. S. Rajagopalan, M.Sc., Haffkine Institute, Bombay. (ii) Mr. N. C. Datta, M.Sc., Haffkine Institute, Bombay. (iii) Mr. K. Ramamurthi, M.A., B.Sc. (Hons.), University Biochemical Laboratory, Madras. (iv) Miss Mary Samuel, B.A., M.Sc., University Zoological Laboratory, Madras. (v) Miss Beatriz de Menezes Braganca, M.Sc., University College of Science, Calcutta. (vi) Mr. Sudhir Ranjan Das, M.Sc., Bose Research Institute, Calcutta. (vii) Mr. M. V. Lakshminarayana Rao, M.Sc., Indian Institute of Science, Bangalore.

University of Dacca.—At the meeting of the Executive Council held on the 6th February 1942, it was resolved "That students on transfer certificates from the University of Calcutta be admitted to this University provided they have kept up the required percentage prescribed by the regulations of the Calcutta University and that their cases for condonation of shortage of attendance or residence be sympathetically considered only if they fulfil the ordinances regarding residence and attendance in this University in respect of the period subsequent to 21st January 1942." It was further resolved "That subject to the passing of the necessary validating Act, Statutes and Ordinances by competent authorities, students from Burma, Malaya and from areas which in the opinion of the University are affected by the War, who have completed their courses may be permitted to take the examinations of this University provided their guardians certify that they have completed the courses and were eligible for corresponding examinations in their own University. Further, that students from the same areas may be admitted to this

University in any course on similar certificates from their guardians and in this case this University would be prepared to recognise the period spent by them in their own colleges, for purposes of completing their studies in this University. Provided that any privilege that may be conferred upon such students including the award of diplomas or degrees, is liable to be withheld or revoked if any statement made by the students or their guardians cannot be later substantiated by proper official records issued by competent authorities; and that subject to the above principles, the Vice-Chancellor be authorised to deal with cases for admission coming from Burma, Malaya or other Universities."

University of Delhi.—The extension of the degree course from two to three years is part of the general scheme of reconstruction of higher education in Delhi which has been accepted by the University as well as by the Government of India. The scheme includes *inter alia* three fundamental principles, briefly indicated as follows:—(1) The abolition of the Intermediate Examination, (2) the extension of the High School Course by one year (i.e., extension of the School Course from 10 to 11 years), and (3) the institution of a three-year degree course in the University.

The stage of admission to the University has been a difficult problem for a long time as the present standard of the Matriculation or the High School Examination is not sufficiently high for direct admission to the three-year degree course of the University. The Government of India have, therefore, decided to carry out, in the immediate future, a complete reorganization of Secondary Education in Delhi by improving the High Schools, by extending the School Course by one year (i.e., from 10 to 11 years) and by raising the standard of the High School Examination, so that it may be recognized by the University as a Qualifying Test for admission to a three-year degree course.

MAGNETIC NOTES

May 1942 was comparatively less disturbed than the previous month. There were 15 *quiet* days, 15 days of *slight* disturbance and one day of *moderate* disturbance as against 5 quiet days, 22 days of slight disturbance and 4 of moderate disturbance during May 1941. The day of largest disturbance during May 1942 was the 14th and the quietest day was the 13th. The classification of the characters of individual days was as follows:—

Quiet days	Disturbed days	
	Slight	Moderate
3, 7-9, 12, 13, 16-19, 21, 25, 26, 30, 31.	1, 2, 4-6, 10, 11, 15, 20, 22-24, 27-29.	14.

No magnetic storm was recorded during the month of May 1942, while a moderate storm was recorded during the same period of last year. The mean character figure for the month was 0·55 as against 0·97 for May 1941.

M. R. RANGASWAMI.

SEISMOLOGICAL NOTES

During the month of May 1942 one great, two moderate and seven slight earthquake shocks were recorded by the Colaba seismographs as against one feeble, three slight and three moderate ones recorded during the same month in 1941. Details for May 1942 are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.		Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
		H.	M.	(Miles)		(Miles)	
5	Slight	09	01	340	..	..	
14	Great	07	43	10210	..	..	
15	Slight	19	44	460	..	..	
15	Slight	22	25	1270	..	..	Epicentral region probably in the Hindu Kush mountains.
23	Slight	07	47	1050	..	..	
24	Slight	01	32	690	..	..	
24	Moderate	08	57	1890	Near Lat. 4°·5 N., Long. 96°·5 E. in Sumatra.	..	
27	Slight	09	04	790	..	..	
28	Moderate	06	31	3930	..	190	
28	Slight	20	50	1450	..	..	

ASTRONOMICAL NOTES

The earth will be in aphelion on July 6.

Planets during July 1942.—Mercury should be easily observable in the morning sky during the first half of the month, the greatest western elongation from the Sun (21° 23') being reached on July 6. Venus continues to be visible as a fairly brilliant star in the morning twilight; it is moving slowly towards the Sun and gradually getting fainter. Mars will be approaching the Sun in the evening sky and rapidly fading in brightness and will not be in a favourable position for observation for the remaining part of the year.

Jupiter and Saturn are both morning stars; the former will, however, be too near the Sun to be easily visible until the end of the month. Saturn is moving slowly eastwards in the constellation Taurus; on July 4 will occur a close conjunction of this planet with Venus, the angular distance between the two objects at the time of nearest approach being only about 4 minutes of arc. An occultation of some importance that will be visible in this country is that of the first magnitude star Aldebaren (α Tauri) occurring on July 10.

One of the prominent meteoric showers—the Detta Aquarids—have their maximum display about July 28. The position of the radiant point in the sky is given by R.A. 340° Declination 12° South and the meteors of this group are known to have slow long paths.

T. P. B.

ANNOUNCEMENT

The Sugar Technologists' Association of India.—It has been tentatively decided to hold the *Eleventh Annual Convention of the Sugar Technologists' Association of India* in Cawnpore, in conjunction with the Annual General Meeting of the Indian Sugar Mills Association, in the month of September 1942.

Papers dealing with original researches, new designs, calculations and new applications of known processes and equipments and also on subjects of technical and general interest to the Indian Sugar Industry, *e.g.*, agriculture, cane diseases and pests, sugar manufacturing processes, chemical control, etc., will be received by the Secretary upto the 30th June 1942. All members of the Association and others connected with the Industry are requested to contribute papers and may please intimate the Secretary as to the number of papers they are likely to contribute.

* * *

We acknowledge with thanks receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 90, Nos. 4606 and 4608.

"Journal of Agricultural Research," Vol. 64, Nos. 3-4.

"Indian Journal of Agricultural Science," Vol. 12, Pt. 2.

"Biochemical Journal," Vol. 35, Nos. 10 & 11.

"Biological Reviews," Vol. 17, No. 1.

"Journal of Chemical Physics," Vol. 10, No. 3.

"Journal of the Indian Chemical Society," Vol. 19, No. 3.

"Experiment Station Record," Vol. 86, No. 3.

"Indian Forester," Vol. 68, No. 6.

"Transactions of the Faraday Society," Vol. 38, Parts 2 and 3.

"Indian Farming," Vol. 3, No. 5.

"Indian Central Jute Committee (Bulletin)," Vol. 5, No. 2.

"Review of Applied Mycology," Vol. 21, Pt. 2.

"The Mathematics Student," Vol. 9, No. 4.

"Bulletin of the American Meteorological Society," Vol. 22, No. 10; Vol. 23, No. 1.

"Indian Medical Gazette," Vol. 77, No. 5.

"Journal of the Bombay Natural History Society," Vol. 43, No. 1.

"Journal of Nutrition," Vol. 23, Nos. 1-3.

"Nature," Vol. 149, Nos. 3770-72, 3774-76.

"Journal of Research (National Bureau of Standards)," Vol. 27, No. 6; Vol. 28, Nos. 1-2.

"Canadian Journal of Research," Vol. 20, Nos. 1-2.

"Science," Vol. 95, Nos. 2453-55; 2457-63.

"Sky," Vol. 1, Nos. 4 and 5.

"Science and Culture," Vol. 7, Nos. 11 & 12.

"Sankhya," Vol. 5, Part 4; Vol. 6, Part 1.

"Indian Trade Journal," Vol. 145, 1869-76.

"Journal of the American Museum of Natural History," Vol. 49, Nos. 1-2.

"Indian Journal of Veterinary Science and Animal Husbandry," Vol. 12, Pt. 1.

Books

Studies in Phylosophy. By M. A. Venkata Rao. Hosali Press, Bangalore), 1942. Pp. vi + 254. Price Rs. 5 or 7*sh.* 6*d.*

Radiology Physics: An introductory course for medical or pre-medical students and for all radiologists. By J. K. Robertson. (Chapman & Hall, London), 1941. Pp. xv + 270. Price 18*sh.*

Year-Book No. 40, Carnegie Institution of Washington, Washington, D.C., 1941. Pp. xxxii + 346. Price $1.00 for paper cover, and $1.50 for cloth binding.

Advances in Enzymology, Vol. II. Edited by Nord and Werkman. (Inter-Science Publishers, Inc., New York, N.Y.), 1942. Pp. viii + 374. Price $5.50.

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